



FLOODPLAIN HABITAT ASSESSMENT

FOR

ISD HOLLY STREET CAMPUS - CREEK BANK REPAIR ***CITY OF ISSAQUAH***

Wetland Resources, Inc. Project #21034

Prepared By:

Wetland Resources, Inc.
9505 19th Avenue SE, Suite 106
Everett, WA 98208
(425) 337-3174

Prepared For:

Issaquah School District #411
Attn: Janelle Walker
5150 220th Ave SE
Issaquah, WA 98029

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ISD HOLLY STREET CAMPUS - PERMANENT STREABANK STABILIZATION (NELSON
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1.0 INTRODUCTION

Project Name:	ISD Holly Street Campus - Creek Bank Repair
Applicant:	Issaquah School District #411 Attn: Janelle Walker 5150 220th Ave SE Issaquah, WA 98029 Phone: 425-864-2059
Authorized Agent:	Wetland Resources, Inc. Attn: Alia Richardson 9505 19th Ave. SE, Suite 106 Everett, WA 98208 Phone: 425-337-3174
Project Site Address:	565 Northwest Holly Street; Issaquah, WA 98027
Jurisdiction:	City of Issaquah
Section/Township/Range:	Section 28, Township 24N, Range 6E, W.M.
Latitude, Longitude:	47.5366443°N, -122.0464962°W
Tax Parcel Number(s):	2824069012
Water Resource Inventory Area:	WRIA 8-Lake Washington/Cedar/Sammamish

The subject site is a 19.31-acre parcel located at 565 Northwest Holly Street, in the City of Issaquah, Washington, (parcel number: 2824069012) within a portion of Section 28, Township 24N, Range 6E, W.M. The site is located in the Issaquah Creek drainage basin within the Cedar-Sammamish Watershed; Water Resources Inventory Area 8. Two access points to the subject site exist. One is located along the western property line via Newport Way Northwest and the second is located along the northern property line via Northwest Holly Street.

Issaquah Creek is located along the northeastern portion of the subject property. The creek is classified as a Shoreline of the State (Type S). Type S waters have 250-foot riparian buffer zones (RBZ) and 100-foot critical area buffer (City of Issaquah Municipal Code IMC 18.10). The 100-year floodplain (Floodway Fringe) and floodway of Issaquah Creek cover a portion of the eastern side of the subject property, as mapped by the Federal Emergency Management Agency (FEMA) in the FIRM map panel 53033C0691J (eff. 08/19/2020), see Appendix A. The base flood elevation (BFE) on the subject property is 73.9 feet (NAVD88), as determined by FEMA.

The applicant proposes to replace the temporary bank stabilization, that was installed in March 2021, with permanent bank stabilization measures.

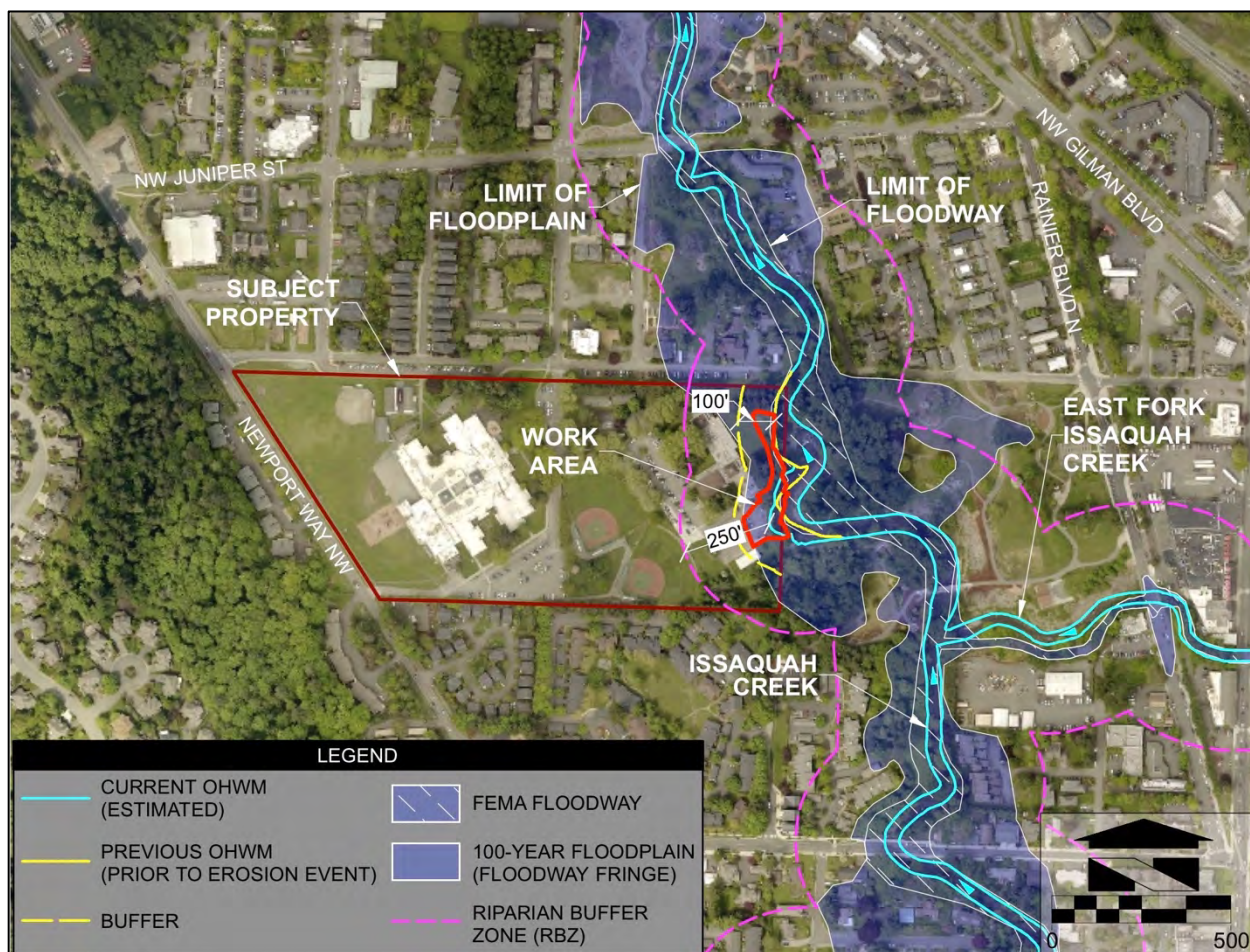


Figure 1 - Vicinity map of the subject property.

1.1 PURPOSE OF STUDY

Development activities proposed within the regulatory floodplain require a Floodplain Habitat Assessment to determine if there are project-related impacts to protected habitats and/or species. The Floodplain Habitat Assessment shall be prepared pursuant to the 2013 FEMA *Floodplain Habitat Assessment and Mitigation Regional Guidance for the Puget Sound Basin* and City of Issaquah's *Flood Hazard Permit - FEMA/ESA Habitat Assessment Checklist*.

In response to a Biological Opinion (BO) prepared by the National Marine Fisheries Service (NMFS) in 2008, FEMA enforces Endangered Species Act (ESA) regulations through the protection of natural functions and processes of special flood hazard areas. Jurisdictions enrolled in the National Flood Insurance Program (NFIP), including the City of Issaquah, must follow minimum criteria to prevent any net adverse effects to ESA-listed species, and their designated habitats, within 100-year floodplains.

The 2008 BO for Puget Sound specifically addresses salmon species and orcas under NMFS, however, pursuant to 2013 FEMA *Floodplain Habitat Assessment and Mitigation Regional Guidance for the Puget Sound Basin* and City of Issaquah's *Flood Hazard Permit Application*, all ESA-listed plant and animal species potentially in or near the project area must be addressed. Potential ESA-listed species within the Puget Sound region, and thus regulated under the NFIP, include those listed in Table

1, below. This list was created from U.S. Fish and Wildlife Service (USFWS 2021) IPaC and NOAA's ESA Threatened and Endangered Species Directory (NOAA 2021).

Species regulated under the NFIP within the Puget Sound region include those listed in Table 1, below. Maps of these species' populations and Critical Habitat are included in Appendix D.

Table 1 - Listed Species in Puget Sound Region Subject to NFIP Regulation

<i>Common Name</i>	<i>Scientific Name</i>	<i>Federal Status</i>	<i>Regulatory Agency</i>
Steelhead - Puget Sound DPS	<i>Oncorhynchus mykiss</i>	Threatened	NMFS
Chinook - Puget Sound ESU	<i>Oncorhynchus tshawytscha</i>	Threatened	
Chum- Hood Canal Summer ESU	<i>Oncorhynchus keta</i>	Threatened	
Sockeye - Ozette Lake ESU	<i>Oncorhynchus nerka</i>	Threatened	
Killer whale - southern resident	<i>Orcinus orca</i>	Endangered	
Bull Trout - Puget Sound DPS	<i>Salvelinus confluentus</i>	Threatened	USFWS
Marbled Murrelet	<i>Brachyramphus marmoratus</i>	Threatened	
Streaked Horned Lark	<i>Eremophila alpestris strigata</i>	Threatened	
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	Threatened	

1.1.1 Protected Area

The *Protected Area* consists of those lands within the combined outermost boundary of the floodway, the channel migration zone (CMZ) plus fifty feet, and the riparian buffer zone (RBZ).

Within the project area, the regulatory floodway of Issaquah Creek is located near the ordinary high water mark (OHWM) of the stream. The CMZ is not identified for this reach of Issaquah Creek in the area of the subject site. As no CMZ is mapped for the area, the entire floodplain is assumed to be within the CMZ. Additionally, the RBZ of a Type S stream (such as Issaquah Creek) is 250 feet from the OHWM, which does fall outside the bounds of the floodplain in the immediate project area. Given the extent of the CMZ where the proposed project is located, the entire floodplain is within the "federally protected area." FEMA does not extend the Protected Area beyond the mapped 100-year floodplain (NMFS 2008).

2.0 PROJECT DESCRIPTION

During the winter of 2019-2020, during periods of unusually heavy, prolonged rain, Issaquah Creek experienced extensive erosion of its west bank along the eastern boundary of the subject site.



Figure 2 - Previous condition of bank prior to erosion event, May 2018 (Source: Google Maps).



Figure 3 - Extent of bank erosion of Issaquah Creek during the March 19, 2020 site visit.

An initial geotechnical assessment performed by Associated Earth Sciences, Inc. (*Geotechnical Design Recommendations – Issaquah Creek Bank Erosion Repair*, dated July 9, 2020) determined that unless stabilized, the channel erosion would continue to encroach into the District’s property. Further erosion would cause damage to existing infrastructure and posed a safety hazard. A temporary emergency bank stabilization measure was installed to prevent damage to existing infrastructure on the site and ensure safety. The temporary stabilization was installed in March 2021. In order to avoid further erosion of the creek bank, the temporary stabilization will be removed as part of the construction of the permanent stabilization project. The current proposed project is for installation of more comprehensive, permanent stabilization measures consistent with

bioengineering techniques required by multiple agencies and the City of Issaquah.



Figure 4 - Installed temporary bank stabilization measures and site conditions, facing northeast (October 8, 2021)

The permanent stabilization project will consist of installing streambank protection along approximately 130 feet of cutbank on the west side of Issaquah Creek. Protection will include reconstruction of a portion of the bank lost to channel erosion in proximity to Issaquah School District infrastructure with an engineered, non-deformable ‘log toe’ incorporating large woody debris and habitat boulders. The log toe will provide protection against the erosive forces directed toward the bank, and provide valuable fish habitat. Habitat boulders will anchor the large woody debris for normal and moderately-high flow flood stages of the stream. Mechanical anchors are included in the design as a supplemental security measure. The woody debris will be situated such that the future possible effects of channel scour are mitigated as much as four feet below the existing channel bottom. Native plants will be installed within the jute soil bags at the top of the stabilization structure, adjacent to the existing parking lot. As the bioengineered structure decays, revegetation within the reconstructed bank will take hold and form permanent, long-term stabilization.

Construction of the stream bank stabilization measures will include work within the ordinary high-water mark of Issaquah Creek, the 100-year floodplain, and a small portion of the mapped floodway. To facilitate work within the stream and reduce impacts associated with construction, fish will be removed from the work area and a temporary coffer dam will be installed along the

perimeter to isolate the work area for the duration of construction. All in-water work will be performed between July 1st and August 30th, the approved fish window

A total of 8 hazard trees are proposed for removal along the streambank (see Appendix C). One tree has already been removed during installation of the temporary bank stabilization. Roots of the trees will remain in place to minimize soil disturbance and reduce further bank erosion. Removal of the trees will be mitigated for with restoration of the area with native shrubs and tree replacement in an area north of the work area. Trees are not proposed to be replaced within the same location as those removed, due to the proximity to the existing administration building and the potential hazard they would pose. Clearing limits are along the portions of the streambank where tree removal, and large-woody debris installation will occur (see Figure 5 below).

All requirements of Issaquah Municipal Code (IMC) chapter 16.36 and any additional permitting conditions will be adhered to.

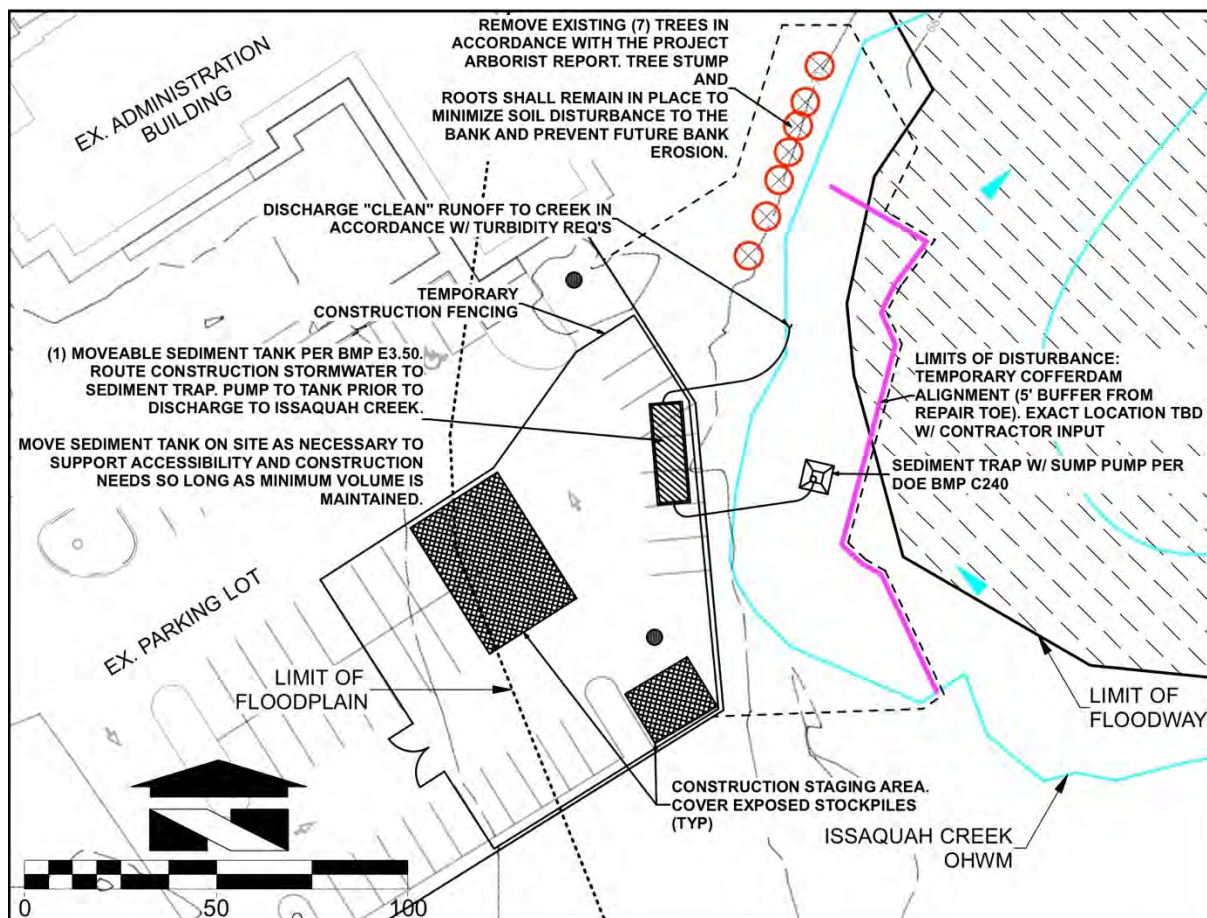


Figure 5 - Proposed Site Plan - Prior to Installation

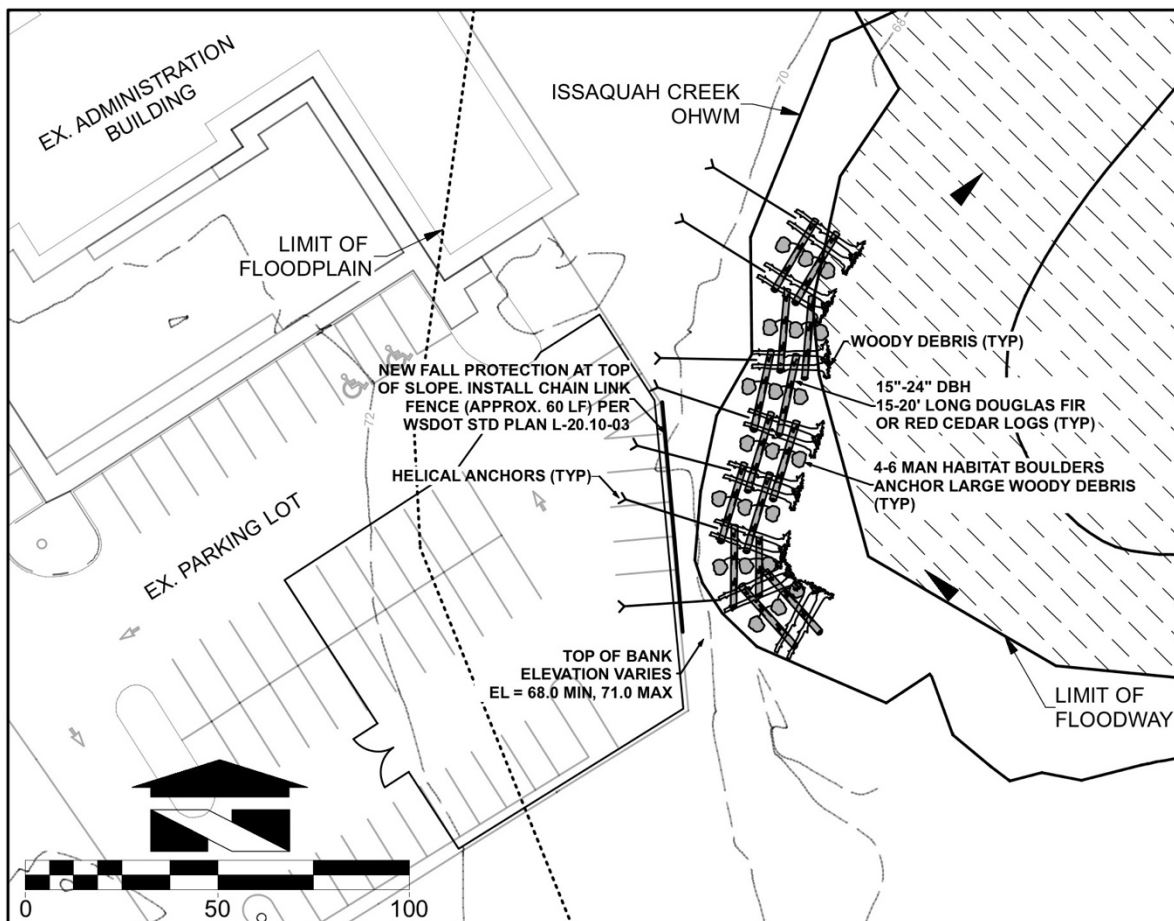


Figure 6 - Proposed Site Plan - Bank Stabilization

Floodplain Avoidance

The preferred method of ensuring no adverse effect to ESA species or environmental factors within the floodplain is avoidance of any development activities in the Special Flood Hazard Area. However, impacts are unavoidable due to the location of the parking lot and administration building adjacent to Issaquah Creek. Permanent bank stabilization measures are required to protect the existing infrastructure.

Although the project must occur within the floodplain and floodway, the project is designed to mimic natural streambank features similar to those found along Issaquah Creek. The project is further designed to inherently avoid adverse impacts to floodplain functions and impacts are minimized to the furthest extent possible, as outlined in section 2.3: *Conservation Measures*.

2.1 EXISTING SITE CONDITIONS

Since installing the temporary bank stabilization measures the area has partially revegetated and some woody debris (drift logs and brush) has accumulated. Vegetation in this area includes unknown grasses, bindweed (*Calystegia sp.*), reed canarygrass (*Phalaris arundinacea*), bull thistle (*Cirsium vulgare*), and Himalayan Blackberry (*Rubus armeniacus*).



Figure 7 - Existing conditions, facing south. (October 8, 2021)

Issaquah Creek is mapped as supporting a variety of native fish species. These species include: Chinook, Steelhead, Coho, Sockeye, Kokanee, and Coastal Cutthroat (WDFW 2021b, NWIFC 2021). In addition, Issaquah Fish Hatchery is located 0.5 mile upstream and stocks Issaquah Creek with Coho and Chinook.

2.2 PROPOSED MITIGATION

To mitigate for the removal of trees and impacts to the stream buffer and RBZ, tree replacement plantings and stream buffer restoration are proposed (see Figure 8 below). For more detailed information on critical areas and proposed mitigation please see WRI's *Critical Area Study and Buffer Mitigation Plan* for this project.

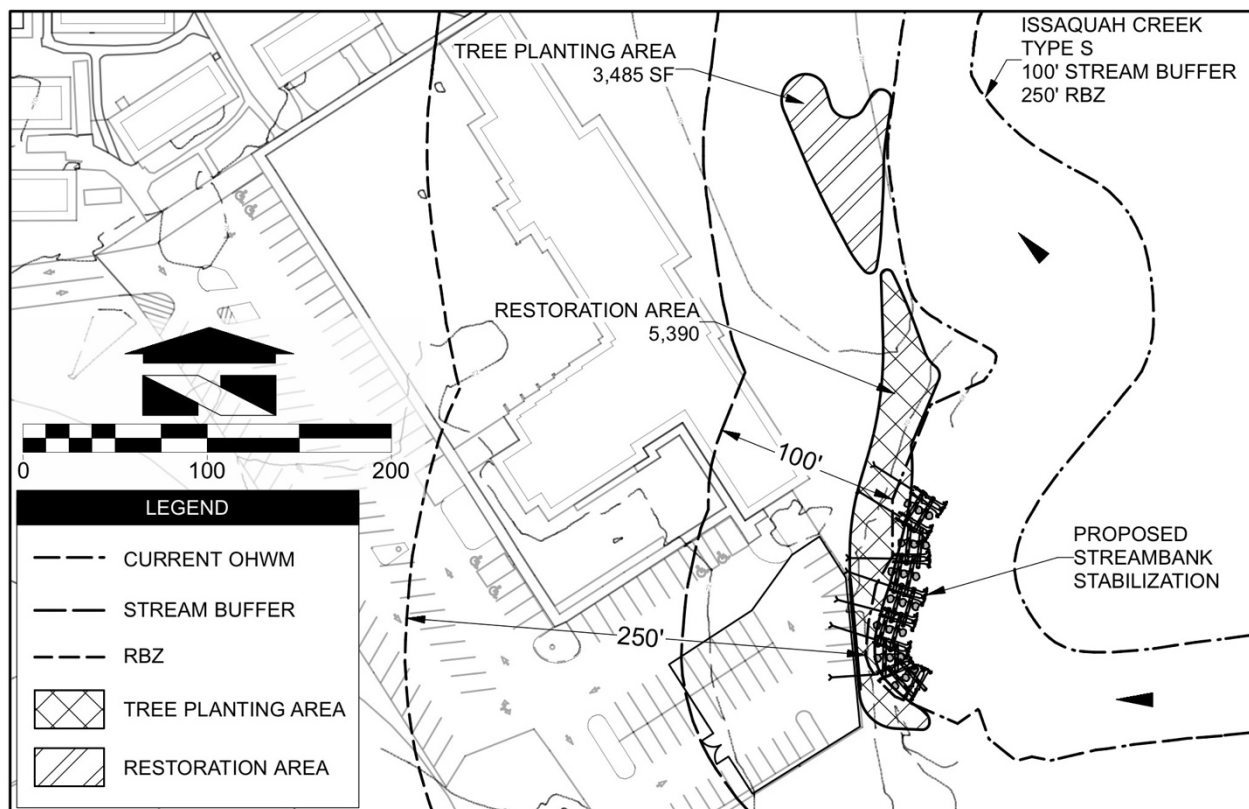


Figure 8 - Proposed mitigation areas

2.3 CONSERVATION MEASURES

Although bank stabilization activities are unavoidable within the floodplain and floodway of Issaquah Creek, impacts are minimized to the maximum extent possible, as outlined below.

- Vegetation removal is limited to the 8 proposed trees and the non-native species that have re-vegetated the temporary streambank stabilization area.
- Stumps and roots of the trees removed will remain to minimize soil disturbance and prevent future bank erosion.
- Bank restoration will include installation of native shrubs.
- Stream bed elevations will be maintained, thereby maintaining the Base Flood Elevation, and avoiding impacts to floodwater storage.
- All conditions of the issued Hydraulic Project Approval (HPA) will be followed.
- Work will be timed during the dry season to avoid flooded conditions, and within specified in-water work window (July 1 - August 31)
- A cofferdam will be installed during the dry season which will exclude any water from the work area.
- Prior to installation, any fish present will be removed from the work area.
- Construction equipment will only run during active operation and will be turned off when not in use. Work will take place during normal daylight hours only.
- All construction activities are proposed outside of the water column.

- Appropriate Best Manage Practices (BMPs) and TESC measures will be in place.

3.0 PROJECT ACTION AREA

An action area is used to identify protected species, habitats, and areas of the floodplain that may be potentially affected by the proposed project. The extent of the overall project action area is the combined geographic coverage of all measurable project-related impacts (including direct, indirect, and interrelated/interdependent actions) within flood hazard areas.

Direct Impacts

The action area for this project is defined by the extent of the clearing limits, installed cofferdam, construction staging areas, and mitigation areas, which covers approximately 21,068 square feet. No areas outside these defined limits will be impacted or experience measurable changes. Construction activities will be accessed from the abutting existing parking lot. Construction of the bank stabilization will permanently alter the floodplain environment by removing the temporary measures, restoring a portion of the streambank, and installing permanent bank stabilizations.

No increase in impervious surfaces is proposed. No measurable changes to floodwater storage are anticipated because the proposed project will comply with IMC 16.36, thereby maintaining the base flood elevation. Sediment generated from installation of the fish exclusion netting will be indiscernible from that naturally occurring in the high-energy system of Issaquah Creek. During installation of large-woody debris, anchors, and habitat boulders the temporary sediment trap will collect silt laden runoff and direct it to a sediment tank. In the tank the surface water will be treated before being released back into the creek. Once construction is complete, cofferdam removed, any remaining sediment introduced into the creek will be indiscernible.

Equipment typically used for tree removal, and installation of streambank stabilization measures will temporarily cause an increase in overland noise pollution during construction activities. Because construction activities are proposed outside the water column, with implementation of a cofferdam, noise pollution from construction activities will only affect the terrestrial environment. Following guidance from WSDOT, potential noise disturbance to aquatic environments is considered discountable, as the water surface is assumed to deflect noise emanating from the terrestrial environment. Given the only species subject to NFIP regulation are located within the aquatic environment, terrestrial noise pollution from construction activities is omitted from the overall project action area.

Indirect Impacts

Typical BMPs and TESC measures will be used surrounding the work site to limit disturbance. Soils will be stabilized after construction activities, as necessary. Construction will occur during the dry season, outside the water column and outside of flooded conditions. These conservation measures are anticipated to prevent the mobilization of sediment/pollutants to areas outside the proposed work area.

Thus, indirect impacts to water quality and sedimentation/turbidity are considered discountable for this project.

Interrelated/Interdependent Actions

No interrelated or interdependent project activities are proposed for the project. This project will have no impact on future or further development in the vicinity.

Overall Project Action Area

The project action area is defined by the extent of the proposed work area within the floodplain and floodway, as displayed in Figure 9 below.

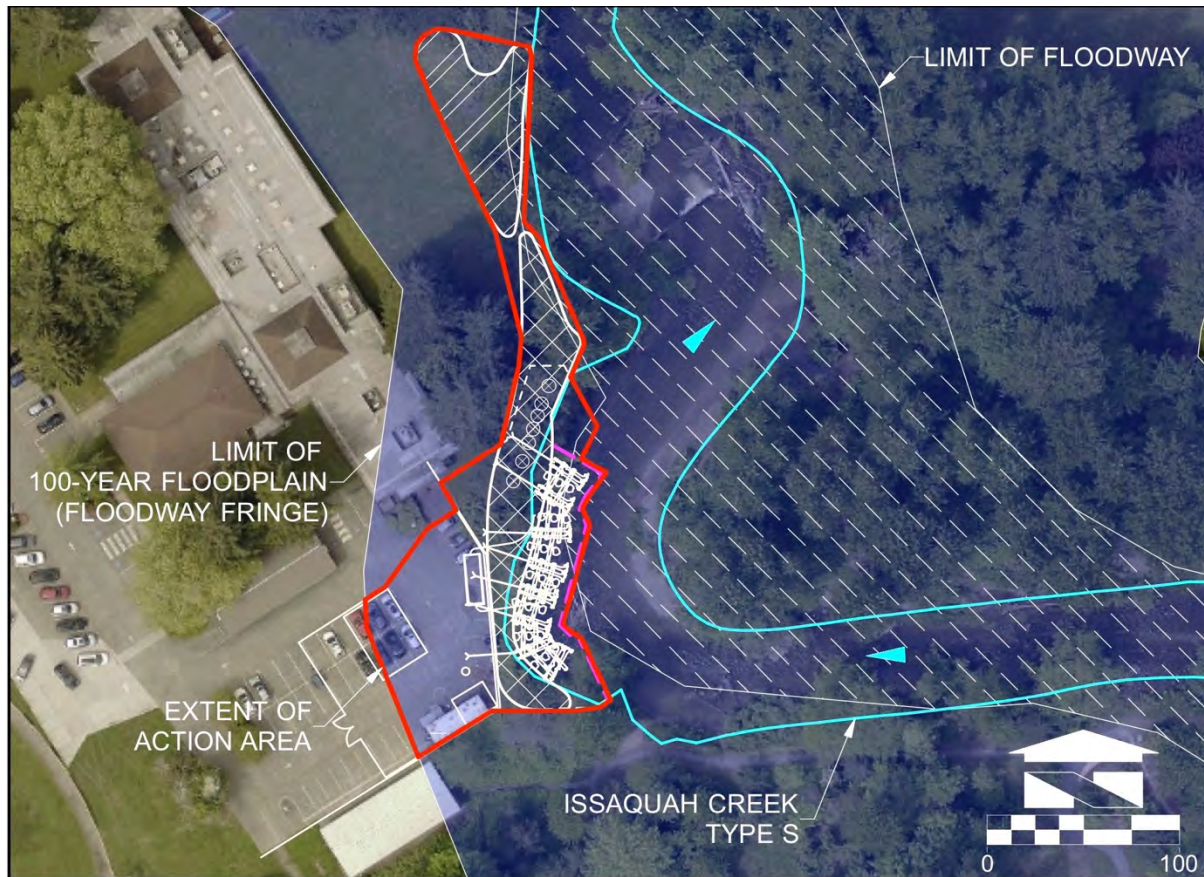


Figure 9 - Project Action Area Shown in Red

3.1 ESA-LISTED SPECIES REGULATED UNDER THE NFIP WITHIN THE PUGET SOUND REGION

ESA-listed species population ranges were determined through NOAA DPS/ESU maps and USFWS Critical Habitat maps (NOAA 2013, USFWS 2010). These population maps are included within Appendix D of this report.

National Marine Fisheries Service (NMFS) and USFWS Critical Habitat Final Rules were reviewed for the presence of designated Critical Habitat within the action area. Maps of these species' Critical Habitat ranges are included within Appendix D of this report.

Steelhead - Puget Sound DPS

The NOAA Fisheries' West Coast Region DPS/ESU boundary map displays the Puget Sound Steelhead DPS overlapping Issaquah Creek (see Appendix D).

The WA State Department of Fish and Wildlife (WDFW) SalmonScape map viewer displays documented spawning of winter Steelhead within the portion of Issaquah Creek adjacent to the project site (WDFW 2021b). The Northwest Indian Fisheries Commission (NWIFC) SWIFD Map Viewer displays documented spawning of winter Steelhead within the same location (Issaquah Creek) displayed by WDFW SalmonScape (NWIFC 2021).

Chinook - Puget Sound ESU

The NOAA Fisheries' West Coast Region DPS/ESU boundary map displays the Puget Sound Chinook ESU overlapping the Issaquah Creek (see Appendix D).

WDFW SalmonScape displays documented spawning of fall Chinook use within the Issaquah Creek (WDFW 2021b). The NWIFC SWIFD Map Viewer displays documented spawning of fall Chinook use within Issaquah Creek as displayed by WDFW SalmonScape (NWIFC 2021).

Chum - Hood Canal Summer ESU

The NOAA Fisheries' West Coast Region DPS/ESU boundary map does not display the Hood Canal Summer Chum ESU overlapping the City of Issaquah or Issaquah Creek in particular (see Appendix D).

WDFW SalmonScape does not display any documented Chum within Issaquah Creek (WDFW 2021b). Likewise, the NWIFC SWIFD Map Viewer does not display the presence of document Chum within Issaquah Creek (NWIFC 2021).

Bull Trout - Puget Sound DPS

U.S. Fish and Wildlife Service (USFWS) does not include Issaquah Creek or any tributaries identified as critical habitat for Bull Trout (USFWS 2010). See Appendix D for this map.

WDFW SalmonScape maps Lake Washington as documented rearing for Dolly Varden/Bull Trout and Lake Sammamish as documented presence (WDFW 2021b). Likewise, the SWIFD viewer maps Lake Washington as documented rearing for Dolly Varden/Bull Trout and Lake Sammamish as documented presence (NWIFC 2020). The closest Bull Trout/Dolly Varden population to the action area is shown within Lake Sammamish, approximately 1.97 miles northwest of the work area (WDFW 2021b, NWIFC 2021).

Sockeye - Ozette Lake ESU

According to the NOAA Fisheries' West Coast Region DPS/ESU boundary map (see Appendix D), the Ozette Lake Sockeye ESU does not have a range that overlaps the Issaquah Creek.

Killer whale - southern resident

The southern resident killer whale only occupies marine environments, which is not located within the vicinity of the project site (see map in Appendix D). The nearest marine environment (Puget Sound) is located approximately 17 miles west of the site.

Marbled Murrelet

The Marbled Murrelet occupies marine environments and old-growth forests, which are not located within the project site. See Appendix F for further justification for this species absence within the action area.

Streaked Horned Lark

The Streaked Horned Lark does not occupy areas north of Pierce County, Washington. See Appendix F for further justification for this species absence within the action area.

Yellow-billed Cuckoo

The Yellow-billed Cuckoo occupy continuous riparia forests, which are not located within the project site. See Appendix F for further justification for this species absence within the action area.

Conclusion

ESA-listed species within the action area include Steelhead (Puget Sound DPS) and Chinook (Puget Sound ESU). These species are mapped within the portion of Issaquah Creek adjacent to the project site. ESA-listed species located near the action area and within Lake Sammamish include Bull Trout (Puget Sound DPS). The life histories of these species and their stock statuses are included in Appendix E of this report. No Critical Habitat for any of the above species is located within or in the vicinity of the action area. Maps of these species designated Critical Habitats are included within Appendix D of this report.

4.0 PROJECT EFFECTS ANALYSIS

This document analyzes the effects of both direct and indirect impacts of the project action, as well as any interrelated/interdependent or beneficial activities. Cumulative impacts are considered for reasonably foreseeable projects beyond the subject project scope.

4.1 EFFECTS ON FLOODPLAIN FUNCTIONS

Pursuant to FEMA guidance, floodplain habitat assessments must include an analysis of floodplain habitat and functions, including discussing the effects of the action on water quality, water quantity, flood volumes, flood velocity, flood storage capacity, spawning substrate, and floodplain refugia.

As previously discussed in section 3.0, the action area is composed of the extent of the proposed work area within the 100-year floodplain and floodway of Issaquah Creek. The majority of the subject property is developed with an elementary school, associated sports fields, parking areas, and administration building. There are isolated patches of trees across the site. The eastern boundary of the parcel includes maintained lawn and trees. Tree species in this area include black cottonwood (*Populus balsamifera*), Douglas fir (*Pseudotsuga menziesii*), and western red cedar (*Thuja plicata*).

Water Quality

The portion of Issaquah Creek adjacent to the subject site is mapped as Category 2 in terms of assessed water quality by the Washington State Department of Ecology (ECY) Water Quality Atlas (ECY 2020a). According to the ECY, “*Waters in this category have some evidence of a water quality problem,*

but not enough to show persistent impairment.” However, the portion of Issaquah Creek located south of the subject site as well as, East Fork Issaquah Creek (to the southeast), and North Fork Issaquah Creek (to the north), are mapped by the ECY as Category 5 polluted waters. According to the ECY, *“If a water body is in this category it means that we have data showing that the water quality standards have been violated for one or more pollutants, and there is no TMDL - or pollution control program in place.”* However, these bodies of water do have TMDLs in place for treating *E. coli* (ECY 2021). These portions of streams are mapped with elevated *E. coli* levels above fecal coliform standards, exceeding this water quality standard. Despite the portion of the Issaquah Creek adjacent to the project area not being mapped as a Category 5, it can be presumed that water within this portion of the stream is likely compromised due the violation of fecal coliform water quality standards located up and downstream of the subject site.

The proposed work area provides limited water quality and retention functions due to a lack of vegetation complexity (filtration, flow reduction), and topographic depressions (water storage, flow reduction). Existing non-native vegetation within the work area provides limited sediment/pollutant control, especially given the relative size of the work area. The proposed project includes removal of 8 hazard trees, and leaving their root systems. After removal this area of streambank will be restored with native shrubs. The native plantings will increase the bank stability and aide infiltration of any stormwater runoff. Conservation measures, as outlined in section 2.3, will include standard BMP and TESC procedures that will prevent direct and indirect impacts to water quality and quantity within the floodplain. Any changes to these functions will be discountable. Water quality and quantity within the action area will not be adversely affected by this project

Floodplain Hydrology

Given the minimal size and condition of the action area, limited flood velocity, flood volume, and flood storage functions are provided by this area. The majority of the action area lacks vegetation complexity that could assist in flow attenuation and water storage. Increases in impervious surface and decreases in vegetation can lead to decreased floodwater retention and increases in stormwater quantity and velocity. The project does not propose an increase in impervious surfaces. The baseline surface and groundwater regimes within the floodplain will be substantially the same after project construction. The height of the streambank will be unchanged. Mitigation measures include restoration of a portion of the stream bank with native trees and shrubs. These plantings will aide in slowing flood waters.

The project will have no impacts on groundwater or hyporheic functions. The base flood elevation will be maintained. Given the insignificant changes proposed, adverse effects to hydrology and flood processes are not anticipated. Baseline hydrology conditions of the floodplain will remain substantially the same. See the *Geotechnical and Engineering Geologic Hazard Evaluation* (Appendix B) for a more detailed analysis of floodplain hydrology impacts.

Floodplain Habitat Elements and Processes

The portion of the streambank that eroded away during the large storm event, in the winter of 2019-2020, originally consisted of native trees and shrubs and Himalayan blackberry. The project site currently provides limited floodplain habitat elements or processes. Existing vegetation lacks complexity, with some native species but a large portion being dominated by invasives. The project area does not provide floodplain refugia from high velocity floodwaters. Given the baseline

vegetation structure and temporary bank stabilizations, the action area does not provide any significant refuge, cover, nesting, foraging, resting, shading, bank stabilization, nutrient cycling, or pollutant removal functions.

The proposed project seeks to provide bank stabilization and restore the stream bank. Bank stabilization measures includes installing large-woody debris and native plantings. To mitigate for hazard trees removed, tree replacements will be installed approximately 110 feet north of the bank stabilization area.

This project will not result in habitat isolation and does not include any channel straightening. No changes to floodplain connectivity will occur. Baseline floodplain habitat conditions will be restored by the proposed project. Floodplain habitat elements and processes within the action area will not be adversely affected.

Conclusion

This project will not adversely affect water quality, water quantity, flood volumes, flood velocities, spawning substrate, or floodplain refugia. No indirect adverse impacts (effects to stormwater, riparian vegetation, bank stability, channel migration, hyporheic flow, or wetlands) are anticipated. An increase in flood hazard area functions is expected after implementation of mitigation measures. Mitigation and conservation measures will return the project area to baseline conditions.

4.2 EFFECTS ON ESA-LISTED SPECIES

This effects analysis pertains to ESA-listed salmonids potentially located in the same watershed as the project. These species include Steelhead (Puget Sound DPS) and Chinook (Puget Sound ESU). The above species are analyzed together as they occupy the same riverine habitat nearest to the action area.

Prior to installation of the cofferdam and construction, fish exclusion netting will be installed and any fish present will be removed and placed downstream of the work area.

Sedimentation and Turbidity

Temporary sedimentation and increased turbidity within the stream may occur during and immediately after the completion of the bank restoration and stabilization measures. Turbidity monitoring will occur downstream of the construction area. After the conclusion of construction activities and the cofferdam is removed, fine sediment may be temporarily suspended in the water column once the stream returns back to the bank, with a potential to redistribute sediment, temporarily altering light penetration, and potentially temporarily increasing pollutant concentration and turbidity in the water column. However, any quantity of particulates that could be reasonably expected to potentially escape would be indiscernible on the overall turbidity of a stream channel as high-energy as Issaquah Creek. Given the rate of discharge for Issaquah Creek (described in section 4.0), it is assumed that hydraulic energy is relatively high in this waterbody (Castro 1995). Streams of this order already generate a base level of turbidity from the stream's substrate and banks. Therefore, given the stream's baseline conditions paired with the proposed TESC measures and filter fabric, any effects to the benthic and aquatic community and downstream listed salmonids from the temporary in water disturbance are anticipated to be discountable.

Structural alterations to floodplain habitat

Measurable effects from structural alterations to floodplain habitat are limited to the extent of the proposed work area. The proposed streambank stabilization measures will include anchoring pieces of large-woody debris, which mimics recruitment similarly to what is found within this river system

No direct or indirect impacts to floodplain structure or functions will occur outside the marked clearing limits. There is no potential for project activities to directly impact the aquatic environment because work is proposed outside the water column, and will only occur during the dry season and approved fish window when flooded conditions are not present. BMP and TESC measures, as outlined in section 2.3, will prevent any indirect impacts to terrestrial and aquatic areas outside the clearing limits.

Conclusion

Any effects to ESA-listed salmonid species within the subject watershed from the proposed permanent bank stabilization actions are anticipated to be discountable.

4.3 CRITICAL HABITAT EFFECTS ANALYSIS

As discussed in section 3.1 and shown in Appendix D, no designated Critical Habitat of any of the above protected species is located within or in the vicinity of the action area. Therefore, there are no potential effects to designated Critical Habitat.

4.4 ESSENTIAL FISH HABITAT ANALYSIS

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 requires that essential fish habitat (EFH) must be identified by NMFS for federally managed marine fish. In addition, federal agencies must consult with NMFS on all proposed actions undertaken or funded by the agency that may affect EFH. The Pacific Fisheries Management Council (PFMC) has designated EFH for the Pacific salmon fishery, for federally managed groundfish, and for coastal pelagic fisheries.

For this project, only species of the Pacific salmon fishery could potentially be affected, as only freshwater systems are located in the action area. The EFH designation for the Pacific salmon fishery includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except above the impassable barriers identified by PFMC. The Pacific salmon management unit includes Chinook, Coho, and Pink salmon. Within the action area, EFH occurs for Chinook and Coho within Issaquah Creek.

This action may have an effect on EFH for Pacific salmon in Issaquah Creek. However, construction activities will occur outside of the water column, during non-flooded conditions. Installation of large woody-debris will mimic those conditions found elsewhere in the riverine system. Large-woody debris in streams and rivers is an important component in fish habitat. They provide habitat features including refuge, shading, foraging, and spawning beds. Additionally, standard BMP and TESC procedures as outlined in section 2.3 will ensure that construction activities are isolated from the surrounding floodplain habitat and aquatic areas.

No direct or indirect effects are expected to associated Prey Species within the action area, due to conservation measures outlined in section 2.3. Any adverse effects to associated Prey Species are discountable.

No permanent, cumulative adverse effects on EFH for Pacific salmon is anticipated to occur as a result of this project. Any future actions within the floodplain will need to meet the same ESA requirements pursuant to the NFIP program, thereby ensuring no future adverse impacts; cumulative or otherwise. Maps of these species' EFH are included in Appendix G.

4.5 INTERRELATED/INTERDEPENDENT ACTIVITIES

No interrelated or interdependent project activities are proposed for the project.

4.6 BENEFICIAL ACTIVITIES

Replacing the temporary bank stabilization with permanent stabilization measures and reconstruction of a portion of the bank have been designed to mimic similar streambank conditions along Issaquah Creek. The installed large-woody debris, habitat boulders, and plantings will re-establish the habitat that was lost during the large storm event. This project will have beneficial effects on fish habitat.

4.7 CUMULATIVE IMPACTS

Cumulative impacts are the incremental effects of an action, together with impacts of present and reasonably foreseeable future actions, beyond the subject project. Cumulative effects can result from individually minor but collectively significant actions taking place over time.

All measurable effects associated with this project are considered temporary, and therefore will not contribute to a cumulative effect with other actions, similar or dissimilar. Additionally, the actions associated with this project will restore and protect the streambank, thereby ensuring no future adverse impacts; cumulative or otherwise. Therefore, no cumulative effects will occur as a result of the streambank restoration project.

5.0 EFFECTS DETERMINATIONS

ESA-Listed Species (Chum, Sockeye, Killer Whale, and Bull Trout)

No Effect

The project has **no effect** on Chum (Hood Canal Summer ESU), Sockeye (Ozette Lake ESU), or Killer whale (southern resident) because:

- These species do not occupy the same watershed or portion of WRIA that work is proposed in.

The project has **no effect** on Bull Trout (Puget Sound DPS) because:

- This species potentially occupies a waterbody downstream of the work area (Lake Sammamish) but is not within the project's action area.

ESA-Listed Species (Chinook and Steelhead)

May Affect, Not Likely to Adversely Affect

The project **may affect** Steelhead (Puget Sound DPS) and Chinook (Puget Sound ESU) because:

- These species may occupy the same waterbody that work is proposed in.

However, the project **is not likely to adversely affect** these species because:

- These species are not present within the action area, because:
 - Work is proposed outside the water column, during the dry season when flooded conditions are not present, and within fish work windows.
 - BMP and TESC measures will prevent any indirect impacts to aquatic areas outside the work areas.
- The action area contains no designated Critical Habitat for these species.
- The proposed project will follow all conditions of the issued WDFW Hydraulic Project Activities (HPA).
- Any effects to floodplain functions will be either discountable or beneficial.

Critical Habitat

No Effect

The project will have **no effect** on any of the potential species Critical Habitat because:

- The project and project-related effects are not located within or adjacent to habitat areas with known Critical Habitat.

Essential Fish Habitat

May Affect, Not Likely to Adversely Affect

The project action **may affect**, essential fish habitat of Chinook and Coho because:

- Temporary increase in sedimentation/turbidity may occur
- Bank stabilization measures include restoring the streambank with large-woody debris and native plantings.

However, the project **is not likely to adversely affect** these EFH because:

- Any increase in sedimentation/turbidity within the water column is considered discountable based on duration, and quantity similar to what is expected in a high-energy riverine system.
- Installation of native plantings and large-woody debris will increase the quality/and quantity of EFH along this portion of Issaquah Creek.

Floodplain Functions

Through the floodplain functions effects analysis outlined in section 4.1, it has been determined that any possible effects to floodplain habitat will be beneficial. Baseline conditions of the floodplain will be **restored**, and **no adverse effects** to floodplain functions or elements are anticipated.

Within the Protected Area, the project will **not adversely affect** the following floodplain elements:

- Water quality,
- Water quantity,
- Flood volumes,
- Flood velocity,
- Flood storage capacity,
- Spawning substrate, or
- Floodplain refugia

6.0 CONCLUSION

The project proposal has an effect determination of **May Affect, Not Likely to Adversely Affect (NLAA)** on Chinook (Puget Sound ESU) and Steelhead (Puget Sound DPS), and EFH, a **No Effect (NE)** determination on Bull Trout (Puget Sound DPS), Chum (Hood Canal Summer ESU), Sockeye (Ozette Lake ESU), Killer whale (southern resident), Marbled Murrelet, Streaked Horned Lark, and Yellow-billed Cuckoo, and a **No Effect (NE)** determination on designated Critical Habitat.

No adverse effects to floodplain functions within the action area will occur, and baseline conditions of the floodplain will be restored. Any effects that may occur from the project action are considered either discountable or beneficial, as described within section 4.0. Potential impacts analyzed in this habitat assessment include direct, indirect, interrelated/interdependent, beneficial, and cumulative.

This project restores the baseline condition of the existing floodplain area and functions. All “General BiOP Minimum Standards” and “Minimum Habitat Assessment Standards” have been met within this assessment.

7.0 USE OF THIS REPORT

This Floodplain Habitat Assessment was prepared for the Issaquah School District as a means of determining potential project effects on ESA-listed species, as well as on the regulated 100-year floodplain, as required by the Snohomish County and the U.S. Federal Emergency Management Agency during the permitting process.

The laws applicable to listed species biology/management are subject to varying interpretations and may be changed at any time by the courts or legislative bodies. This report is intended to provide information deemed relevant in the applicant's attempt to comply with the laws now in effect.

The work for this report has conformed to the standard of care employed by ecologists. No other representation or warranty is made concerning the work of this report, and any implied representation or warranty is disclaimed.

Wetland Resources, Inc

A handwritten signature in black ink, appearing to read 'Alia Richardson', with a stylized, cursive script.

Alia Richardson

Associate Ecologist & Wildlife Biologist

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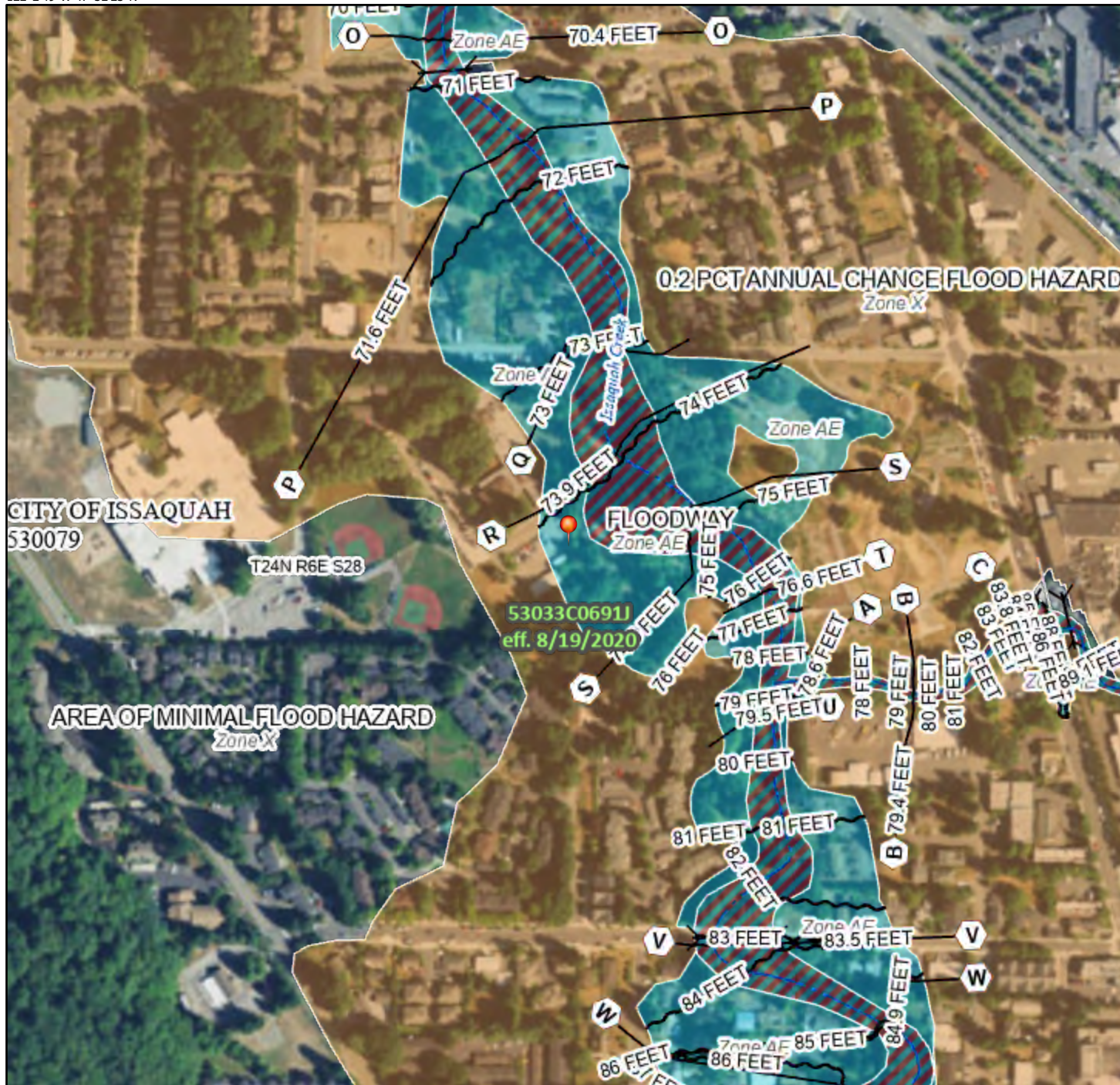
APPENDIX A

FEMA FIRM MAP 53061C1060F

National Flood Hazard Layer FIRMMette



122°2'49"W 47°32'23"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
MAP PANELS		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **10/21/2021 at 6:55 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX B

Geotechnical and Engineering Geologic Hazard Evaluation - *REVISED*
ISD Holly Street Campus - Permanent Streambank Stabilization
(Nelson Geotechnical Associates, Inc.) October 28, 2021



**NELSON GEOTECHNICAL
ASSOCIATES, INC.**

**17311-135th Ave. N.E. Suite A-500
Woodinville, WA 98072
(425) 486-1669
www.nelsongeotech.com**

October 28, 2021

Issaquah School District No. 411
ATTN: Janelle Walker, Capital Projects
5150 – 220th Avenue SE
Issaquah, WA 98029
VIA Email: walkerj2@issaquah.wednet.edu

Geotechnical and Engineering Geologic Hazard Evaluation - *REVISED*
ISD Holly Street Campus - Permanent Streambank Stabilization
565 NW Holly Street
Issaquah, Washington
NGA File No. 1228720

We are pleased to submit the attached report titled “**Geotechnical and Engineering Geologic Hazard Evaluation – ISD Holly Street Campus - Permanent Streambank Stabilization – 565 NW Holly Street – Issaquah, Washington.**” This report summarizes our observations of the existing surface and subsurface conditions within the site, qualifies the geologic hazard presented by Issaquah Creek, and provides recommendations for the design of Streambank Stabilization Methods in relation to the geologically critical areas within proximity of the site. Our services were completed in general accordance with the proposal authorized by Issaquah School District No. 411 on December 4, 2020.

The subject site is situated on the southeastern portion of the School District property at the above address. The eastern portion of the property is occupied by Issaquah Creek, which flows in narrow meander bends to the north in the vicinity of the site. The study area comprises a tenth-of-a-mile reach centered at approximately River Mile 2.85 along Issaquah Creek. The creek channel bottom has an average, approximate elevation of 60 feet above Mean Sea Level (MSL) within proximity of the property, and the upland areas in the southwestern portion of the site have an elevation around 70 feet MSL.

The site has experienced significant erosion associated with Issaquah Creek, and infrastructure has been undercut by the stream after flooding occurred in the 2019-2020 wet season. The site is subject to critical areas mapped by the City of Issaquah. The City and other jurisdictional agencies have requested that an analysis and evaluation of the potential of channel migration within this portion of Issaquah Creek near the site be performed prior to issuance of various permits needed for long-term stabilization. The scope of our work includes an evaluation of the reach of the stream in the vicinity of the affected property in accordance with Section 2 of the Forest Practices Board Manual (Title 222 WAC), Standard Methods for Identifying Bankfull Channel Features and Channel Migration Zones (2004).

The evaluation of the channel migration hazards associated with Issaquah Creek was completed to inform stabilization considerations. We reviewed historic imagery and performed site walk-through evaluations to provide the necessary background data to render our opinions regarding future risks based on the prevailing data and conditions. The project is currently in the preliminary process of plan development, and we understand project plans are iteratively being developed at the time this report was prepared.

We have concluded that a combined bioengineered and structural solution can stabilize the site long-term from the effects of erosion associated with flooding on Issaquah Creek, from a geotechnical and engineering geologic standpoint. Various constraints on the project scope, particularly including the limited area between infrastructure and the original Ordinary High-Water Mark, have narrowed possible methods for long-term stabilization. Stakeholder and jurisdictional preferences and requirements were also considered during the evaluation of stabilization alternatives.

The scope of our services for this project are limited to analysis of channel migration hazards and stabilization with bioengineered methods. Other geologic or environmentally hazardous areas may be present within or in proximity to the site. Our report is meant to be interpreted in conjunction with a biological assessment to address other environmental factors in bioengineered stabilization of the affected stream bank. In the attached report, we have only provided general recommendations for foundations, site grading, erosion control, and drainage, as they pertain to the erosion hazard areas and channel migration hazards within the property and immediate vicinity. We should be retained to review and comment on final stabilization plans prior to construction.

It has been a pleasure to provide service to you on this project. Please contact us if you have any questions regarding this report or require further information.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

A handwritten signature in black ink, appearing to read 'K. Shawish', with a stylized flourish at the end.

Khaled M. Shawish, PE
Principal

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Geotechnical and Engineering Geologic Hazard Evaluation - *REVISED*
ISD Holly Street Campus – Permanent Streambank Stabilization
565 NW Holly Street
Issaquah, Washington

INTRODUCTION

This report presents the results of our geotechnical and engineering geologic investigation of the local stream channel migration hazards and subsequent recommendations for bank stabilization for Issaquah Creek in proximity to the Issaquah School District Holly Street Campus property located at 565 NW Holly Street in Issaquah, Washington. The location of the site is shown on the Vicinity Map in Figure 1. Issaquah Creek flows westward and northward directly east of the property, and flooding in 2019-2020 resulted in substantial erosion to streambanks in the vicinity of the site. Specifically, rapid undermining of parking pavement and now-abandoned utility conduit was experienced on the easternmost portion of the subject site. Project stakeholders pursued temporary streambank stabilization measures consisting of driven steel piles spanned by subsurface metal sheets to prevent further damage to the structures on the property while permanent stabilization methods are designed and permitted.

Streams and other fluvial systems are dynamic and frequently change in response to environmental and anthropogenic (human-caused) forces. Channel migration zones (CMZ) describe areas in proximity to existing stream channels that contain a high risk of occupation by the channel within the next century. The purpose of this study is to delineate the channel migration zone within the study area to determine erosion hazards, then to evaluate integrated streambank stabilization approaches to best mitigate recent erosion and improve bank habitat and resiliency. The basis of evaluation has been conducted in accordance with the provisions of Issaquah Municipal Code (IMC) Section 16.36 and 2013 Shoreline Master Program Section 7.1.3, which outline New Shoreline Stabilization guidelines on Issaquah Creek. A glossary of technical terms used in this study is presented in **Appendix A** for clarity. Since the City of Issaquah does not explicitly regulate technical guidance to be used in geotechnical analyses of stabilization methods, we have evaluated the necessity of stabilization in accordance with elements of Section 2 of the Washington State Forest Practices Board Manual (Title 222 WAC), Standard Methods for Identifying Bankfull Channel Features and Channel Migration Zones (2004). Stabilization alternatives and approaches were evaluated in accordance with the Washington State Department of Fish and Wildlife (WDFW) - Aquatic Habitat Guidelines Program's Integrated Streambank Protection Guidelines manual (Cramer, 2003).

The study area comprises a tenth-of-a-mile reach centered at approximately River Mile 2.85 along Issaquah Creek. The location of the site is presented in the Vicinity Map in Figure 1. The creek channel bottom has an average, approximate elevation of 60 feet above Mean Sea Level (MSL) within proximity of the property, and the upland areas in the southwestern portion of the site have an elevation around 70 feet MSL. The existing site layout and approximate topography is shown on the Site Plan in Figure 2.

SCOPE

The purpose of this study is to explore and characterize the site surface conditions, delineate the erosion hazards associated with the channel migration zone within the study area, and to analyze approaches for bank stabilization, where necessary. Specifically, our scope of services included the following:

1. A review of available soil and geologic maps of the area, as well as relevant geotechnical engineering documentation pertaining to the site and surroundings, as provided.
2. Visiting the site to observe current surface conditions, including areas immediately upstream and downstream of the subject property comprising the affected stream reach.
3. Obtaining and reviewing available topographic surveys, aerial and LiDAR imagery of the area to evaluate historic channel conditions.
4. Reviewing historic flooding conditions on nearby stream gauges.
5. Providing an estimate of historic riverbank recession in proximity of the property.
6. Providing our opinions relative to historic, existing, and future potential channel migration within the vicinity of the subject property.
7. Evaluating streambank stabilization approaches and alternatives in accordance with the City of Issaquah's Shoreline Master Program and WDFW Integrated Streambank Protection Guidelines.
8. Documenting the results of our findings, conclusions, and recommendations in a written engineering geologic and geotechnical report.

SITE CONDITIONS

The site is occupied by an Issaquah School District administration building surrounded by vehicle parking and access on the southern and western sides of the structure. The structure was constructed in 1969, and parking areas in proximity to Issaquah Creek's current alignment within the site are composed of concrete. The southeast corner of the structure is set back approximately 57 feet from the Ordinary High Water Mark (OHWM) of Issaquah Creek, while the parking lot on the southeastern portion of the property is within 9 feet of the OHWM and was undercut by repeated flooding first in the wet season of 2019-2020 and again as late as March of this year.

The facilities operated by Issaquah School District occupy a relatively level, valley-fill terrace above Issaquah Creek. The terrace comprises alluvial fill deposited post-glaciation by Issaquah Creek. In the vicinity of the subject site, Issaquah Creek has a moderate, meandering morphology, but has historically been modified to serve agriculture and development in the region. A LiDAR map of the vicinity of the subject site is presented in Figure 3 for regional geomorphic context.

Within the study segment, as the current channel flows westward in proximity to the site, it dramatically shifts northward, with the turning point located immediately adjacent to the affected parking lot. The site is situated along the outside edge of a 'cut bank' downstream of the confluence with the east Fork Issaquah Creek. Downstream on the same side of the stream, Issaquah Creek meanders in the opposite direction and a 'point bar' continues to form and collect sediment. The creek generally occupies a single channel with a maximum bankfull depth of 6.3 feet, as shown on Cross Sections in Figures 4 through 7. The channel depth varies, and of particular note the channel experiences a small knickpoint immediately upstream of the subject site where embedded logs and debris have enabled drop scour on the order of a couple of feet. Based on a review of stream gauge flow data, the flow volume in Issaquah Creek is most strongly tied to seasonal rainfall.

The 0.1-mile reach centered on River Mile (RM) 2.85 is characterized by steeply sloping eastern banks with actively eroding alluvial sands and gravels exposed at the cutbank. The western bank is a gently- to moderately sloping gravel point bar, with vegetation near elevations in the vicinity of 68 feet MSL. Clasts within the creek are consistently fine to coarse gravel in size, coarsening in proximity to the thalweg. Large woody debris installed at the edge of the previous edge of the cutbank alignment now occupy upper- to mid-channel slopes within the stream in front of the property in the critical portion of the study segment. The fluctuation in river stage and measured flow during flooding periods suggests that much of the material eroded from banks is transported short to moderate distances downstream of the study area, and bedload transportation qualitative measures have a limited capability of estimation within the scope of this study. Several logs and debris accumulation were observed on the cutbank in this reach.

Current Conditions Survey: We visited the property to conduct a current conditions survey on July 1, 2021. We documented channel characteristics and geomorphology near RM 2.85. During our site visit, the discharge officially measured at RM 1.2 from the United States Geological Survey (USGS) Stream Flow Station 12121600, Issaquah Creek Near Mouth near Issaquah, WA (SE 56th Street) was 33.6 cubic feet per second (cfs) corresponding to a river stage of 4.21. Informal measurement at the site during our visit corresponded to a discharge of about 47.45 cfs. For reference, in the past year this stream gauge has measured a range of stages between 3.89 and 14.57, with flows ranging between about 9 and 3,580 cfs.

Conditions of the stream banks and exposed soil stratigraphy of eroding banks and modes of bank failure were noted during our site visit. Subsurface conditions were not explored directly, but photographs of eroding banks and aggradational features were documented to provide a qualitative record of grain size distributions.

Channel morphology was documented in four locations, as shown on Cross Sections in Figures 4 through 7. In general, cross sections show the incision of a ‘scour pool’ landward (west-southwest) of the original OHWM, progressively deepening downstream along the affected cutbank alignment.

Interpreted Subsurface Conditions

Geology: The geologic units for this area are shown in the Geologic Map of the East Half of the Bellevue South 7.5' x 15' Quadrangle, Issaquah Area, King County, Washington, by Derek B. Booth, Walsh, T.J., Troost, K.G., and Shimel, S.A. (USGS, 2012). The regional valley occupied by Issaquah Creek is mapped with a recent mantle of surficial alluvium (river) deposits, and discrete exposures of sedimentary exposures of pre-Fraser glaciation age in upland areas on either side of the regional valley walls, which likely underly the alluvial sediments at depth within the stream channel. We utilized explorations by Associated Earth Sciences, Inc. (AESI) prepared previously for a project on this site to verify subsurface materials. Logs of those explorations are presented in **Appendix B**.

Soils: The Soil Survey of King County Area, Washington, by the Natural Resources Conservation Service (NRCS), classifies the soils in proximity to the site on the southern bank of the River as Briscot silt loam. The material is derived from alluvium and is predominantly located on flood plains.

Site Observations and Exposure Mapping

During our site visit on July 1, 2021, we documented the presence of alluvial materials at the ground surface and in exposures along banks and slopes within the site and nearby vicinity. Bedrock or glacial soil outcrops were not encountered at the site. The cutbank within the site displayed predominantly gravelly, and sandy materials where unobscured by invasive groundcover plants. Elsewhere, banks primarily exposed moderately vegetated sands and gravels generally consistent with previous mapping of alluvium.

Bankfull conditions were determined in accordance with Section 2 of the Forest Practices Board Manual (Title 222 WAC), Standard Methods for Identifying Bankfull Channel Features and Channel Migration Zones (2004). Specifically, bankfull conditions are the average channel dimensions needed to completely fill the channel to a point at which flooding occurs on terraces or at hillslopes. Measured cross sections across Issaquah Creek are presented as Figures 4 through 7 and indicate these interpreted conditions.

Sedimentology: Sediment has historically been supplied by Issaquah Creek to the study area and beyond by landslides and incision along the steep, upper valley tributaries in the Tradition Plateau and Issaquah Alps highland areas. Sedimentary rocks and upland glacial fill gravel sediments within the stream are derived from erosion in the highlands to the south and east of Issaquah. Abundant local sediment sources exist in proximity to the subject stream reaches, and are being actively eroded during peak flow events, mobilizing cobble, gravel, and sand material from older alluvial valley fill.

Hydrogeologic Conditions

The capacity for Issaquah Creek to avulse from its channel has been strongly affected by urbanization and development in Issaquah; however, migration and erosion most frequently occurs during periods of flooding, where peak flow provides the stream with enough energy to erode banks and transport oversize gravels and cobbles. Flow levels downstream of major confluences on Issaquah Creek have been continuously monitored by the USGS at RM 1.2 with Stream Flow Station 12121600, Issaquah Creek Near Mouth near Issaquah, WA (SE 56th Street) since October 10, 1986, although water data back to 1945 are available from this station. The basin area for the gauge is approximately 56.6 square miles. Flooding on Issaquah Creek is officially recognized when the stage is higher than 7.5 feet on an upstream gauge near Hobart, generally and informally corresponding to a measurement of 9.5 feet on this gauge. Data from the stream gauge were reviewed for peak flow conditions, although precise flood recurrence intervals were not computed based on project scope limitations. Furthermore, historical flow events cannot be used as a precise prediction of future conditions due to changing land use and local climatic impacts. Significant flow events organized by date are indicated in Table 1 below.

Table 1 – Selected Historical Peak Flow Events on Issaquah Creek in Issaquah, WA

Date	Gauge Stage (ft)	Stream Flow (cfs)	Date	Gauge Stage (ft)	Stream Flow (cfs)
01/09/1990	13.5	3,200	11/26/1998	11.18	1,870
11/24/1990	13.43	2,410	01/01/1997	11.16	1,830
11/24/1986	13.2	3,100	12/03/2007	11.15	1,970
02/08/1996	12.84	2,420	02/19/1995	10.8	1,740
01/08/2009	12.56	2,450	12/15/1979	10.7	1,940
02/06/2020	12.33	2,620	01/24/1982	10.64	1,920
01/25/1984	11.79	2,330	12/12/2010	10.64	2,060
01/19/1986	11.52	2,300	01/29/2004	10.48	1,750
11/14/2001	11.5	2,080	02/28/1972	10.23	2,260
11/06/2006	11.5	2,080	02/09/2017	9.71	1,510
12/03/1975	11.46	2,870	01/11/2006	9.68	1,500
12/09/2015	11.41	2,000	12/11/2004	9.53	1,460
01/05/1983	11.18	2,110	04/05/1989	9.51	1,330

Woody debris can affect channel migration by diverting flow away from sensitive banks or focusing erosive energy and directing flow if a log jam blocks the active channel. This process can also contribute to avulsion hazards. Wood can be moved downstream or deposited and stored within the channel. During historical aerial review and our site visit, we noted the presence of only individual large logs, sporadically distributed and periodically moved. These logs present only localized influence on channel morphology and are typically located along banks.

Historical Conditions

Aerial Review: Historical channels and locations were determined from available aerial imagery and topographic maps listed in Table 2. Due to mapping discrepancies, the available topographic maps which include the site only provide a general sense of the map-scale channel form and lacks high enough scale to determine the Historic Migration Zone (HMZ) by tracking the lateral position of the channel. Aerial photographs also do not provide best channel position data due to the historically highly vegetated channel being obscured. Rough channel form was determined by aerial imagery review, which suggested avulsion events likely occurring during flooding in 1986 shifting the alignment toward an easterly channel, then again in 1990, shifting the alignment westerly and meandering toward the school district structures. The channel has occupied the same form in the vicinity of the site since approximately 1990 and appears to have been progressively eroding the cutbank since that time.

Table 2 – Historical Aerial Imagery used to Delineate Channel Positions

Date	Type	Source
1936	Aerial Photograph	King County
1964	Aerial Photograph	USGS
1968	Aerial Photograph	USGS
1969	Aerial Photograph	USGS
1980	Aerial Photograph	USGS
1981	Aerial Photograph	USGS
1990	Aerial Photograph	USGS
1998	Aerial Photograph	King County
2000	Aerial Photograph	King County
2002	Aerial Photograph	King County
2003	LiDAR Imagery	WADNR
2005	Aerial Photograph	King County
2005	LiDAR Imagery	Terrapoint
2009	Aerial Photograph	King County
2012	Aerial Photograph	King County
2013	Aerial Photograph	King County
2015	Aerial Photograph	King County
2016	LiDAR Imagery	Quantum Spatial
2017	Aerial Photograph	King County
2019	Aerial Photograph	King County

Regional geomorphic features which may be imperceptible at ground level can be inferred remotely through aerial imagery and data. Light Detection and Ranging (LiDAR)-derived imagery shows mathematically interpolated ground surface elevations by removing vegetation interference. Publicly available LiDAR data for the site were reviewed from a report titled “PSLC King County 2016-2017 LiDAR Final Technical Report.” These data were acquired by Quantum Spatial between February and August of 2016. Figure 3 presents the most recently available LiDAR data utilized in this study.

Patterns: LiDAR data were used to identify recent, historic, and relic alluvial features. Relic meander channels are located to the north, east, and southeast of the subject property. The stream channel within the study segment appears to have been modified by the placement of large woody debris in the channel. The timing of the bank modifications is unclear. Meander positions appear generally constant in the record and additional meander growth appears to be fairly well constrained outside the subject cutbank. All the actively eroding bank locations are composed of non-cohesive materials, which support moderate erosion rates based on the historical trend in the area. Short term bank erosion rates at the subject meander throughout a recent photographic record (since 2005) range from 1.9 ft/yr to 2.2 ft/yr within the actively eroding banks, and a rate of 14.9 ft/yr during the 2020 flooding season.

Historically-Reconstructed Rate of Migration: The reach-averaged bank erosion rate for the CMZ delineation reach affecting the site was calculated by dividing the total eroded floodplain area interpreted to be shown in the historical aerial photograph record by the length of the bank edge adjacent to the floodplain, then by the number of years composing the record. The oxbow lake to the southeast of the site was removed from the Historical Migration Area calculation because its origin and periodic presence was likely an agricultural irrigation modification in the early- to mid-20th century.

Table 3 – Reach Variables Utilized in Calculation of Long-Term Average Bank Erosion Rate

Variable	Value
1936 Active Channel Area	78,840 ft ²
2021 HMZ Area	145,052 ft ²
Historically Eroded Area	66,212 ft ²
Erodible Length	1,045 ft
Average Erosion Rate	0.75 ft/yr

The bank erosion rate was generally consistent across the study area, outside the subject meander. In specific proximity to the subject site, the main channel migrated a total of about 64 feet westward in 85 years, with an average rate of 0.75 feet/yr. Meander erosion was substantially greater, as previously described.

SENSITIVE AREA EVALUATION

Channel Migration Zone (CMZ) Delineation

We utilized the guidelines in Section 2 of the Forest Practices Board Manual (DNR, 2004) to delineate the CMZ within proximity to the study site. In accordance with the guidelines, a CMZ comprises three distinct areas: the Historical Migration Zone (HMZ), the Avulsion Hazard Zone (AHZ), and the Erosion Hazard Area (EHA). Our CMZ delineation is presented in Figure 8.

Historical Migration Hazard (HMZ): The historical migration hazard was delineated as the spatial sum of all interpreted channels and active side channels originating in the subject reach and visible in aerial photography between 1938 and 2018. To account for distortion and error, slight adjustments were made to match photography to current LiDAR imagery. Due to the extensive forested canopy near the stream, the bank line was sometimes obscured by vegetation and approximated.

Avulsion Hazard Zone (AHZ): Relic side channels seen on LiDAR imagery and historic avulsions recorded in the aerial photography indicate that avulsions are possible in the study area. Avulsion hazards were delineated within floodplain areas where bankfull conditions may selectively divert flow to topographic low points. Systemic aggradation or woody debris may also affect the possibility of avulsion within the study area. Depending on concentrations of flow, avulsion may occur within the point bar of the meander across the river from the property, especially if the side channel develops at a rapid pace.

Erosion Hazard Area (EHA): The Erosion Hazard Area is based on the average bank erosion rate within the reach. We calculated the average erosion rate to be 0.75 ft/yr, but localized rates vary. All actively eroding banks have exposures of alluvial materials. The average rate of erosion was extrapolated over the 75-year design life of a structure to determine the erosion hazard area. A 56-foot erosion buffer has therefore been conservatively applied to the outside of the main channel, beginning along the top of the steep bank slope within the subject property and extending westward.

Disconnected Migration Areas: Disconnected migration areas are those which are behind permanently maintained levees, dikes, or public rights-of-way. No disconnected migration areas were mapped within the project vicinity.

Scour Assessment

The subject site is situated on a meander where a significant change in flow direction occurs. When streams bend, the deepest portion of the cross section moves to the outer portion of the channel and scour occurs at the bend location – the cutbank. High shear stress develops immediately downstream of the bend and increases proportionally with the relative tightness of the bend.

Similarly, an abrupt bend in the stream accommodates erosive energy in a ‘sink’ and can create ‘jet scour’ pools at the bend to dissipate the energy of the flow’s momentum as it changes direction. The landward pools shown on the Cross Sections in Figures 5 through 7 depict this method of scour.

Estimations of scour depth can be made with empirical formulae for most types of scour, with the exception of ‘jet’ scour, which will continue to occur until an equilibrium is met between the energy sink and the erosive momentum of the flow. For the purposes of approximating scour depth at the meander to facilitate repair and stabilization alternatives, we calculated scour depth based on the empirical Thorne formula for meander scour.

Equation 1 – Thorne Equation for Meander Scour:

$$\frac{d}{y_1} = 1.09 - \log\left(\frac{R_c}{W} - 2\right) \text{ for } 2 < \frac{R_c}{W} < 22$$

Where:

d= maximum depth of scour below local stream bed elevation

*y*₁= average flow depth directly upstream of the bend

W= width of flow

*R*_c= radius of curvature at channel centerline

We calculated an approximate meander scour depth of the stream to be 4.3 feet based on an $\frac{R_c}{W}$ value of 2.97 and an average flow depth of 3.88 feet, determined from aerial imagery and field reconnaissance, respectively.

CONCLUSIONS AND RECOMMENDATIONS FOR STABILIZATION

General

It is our opinion from a geotechnical standpoint that the parking lot and administration facility operated by Issaquah School District is within an erosion hazard area associated with channel migration and other hazards from Issaquah Creek. Without permanent stabilization, the meander will continue to erode and undermine public facilities and infrastructure. Since most highly erosive events in proximity to the site have historically occurred during periods of intense flooding, further alterations to the existing channel are likely to occur in future floods. It is therefore impractical to give a precise lifespan of existing facilities and infrastructure based on background erosion rates, given the changing frequency in which flooding will occur in the future and the dynamic changes in the stream channel morphology which can occur during flood events. For the purposes of this study, we consider the parking lot and underlying utilities to be effectively compromised by the erosion hazard, an active condition which warrants urgent streambank stabilization.

In the remainder of this report, we discuss possible stabilization alternatives for the affected cutbank, implications and impacts on the surrounding channel migration zone from these alternatives and provide design-level recommendations for construction of the most practical methods.

Objective: To take action to restore channel morphology and minimize the risk erosion poses to the parking lot area while protecting the aquatic productive capacity of the site.

Background: We interpret Issaquah Creek to be degrading and incising in the subject stream reach. Evidence for degradation includes historic widening of the alluvial flood plain, continual oversteepening and periodic collapse of banks, and the presence of small knickpoints (thalweg drops) along the channel profile in the vicinity of the site. Given the 14.9-foot recession of the cutbank between 2019 and 2020, it is clear the momentum and energy of the stream is channeled toward the meander below the parking lot, which has been critically undermined. Temporary stabilization measures, while sufficient to prevent ongoing erosion, do not meet standards for streambank stabilization in accordance with the City of Issaquah Shoreline Master Program, or requirements from other agencies for permanent stabilization.

Stabilization techniques will require structural improvements in combination with bioengineering and reconstruction of the bank in order to withstand the erosive power directed at the site, an expected increase in the frequency of flooding events on Issaquah Creek due to changing climate, and cause no net loss in aquatic function in accordance with state requirements.

Technical Design Criteria

To achieve the objective established by Issaquah School District, the following technical design criteria were developed to screen and guide possible stabilization alternatives for the project site:

- Stabilization measures shall account for potential bed degradation of 4.3 feet in the event channel degradation continues.
- At a minimum, bank-toe woody material shall resist buoyancy and shear forces up to and including those that occur during a 10-year recurrent flow.
- Vegetation planted on upper bank shall cover at least 60% of the ground surface by the end of the third year following project implementation.
- At least 80% of the woody plant material shall survive three years after placement.
- Modifications to the bank shall only occur landward of the original OHWM prior to 2019-2020 flooding.
- Project shall be monitored at least annually for 5 years during low-flow periods and during significant flooding events to ensure outcomes are maintained.

Specific requirements for bank stabilization in accordance with the following jurisdictions also screened possible alternatives. An incomplete summary of requirements is presented below for reference.

City of Issaquah – Shoreline Master Program, Chapter 7

Bioengineered shoreline stabilization methods are preferred. New shoreline stabilization shall be planted with vegetation suitable for wildlife habitat. New streambank stabilization structures shall incorporate features that minimize adverse effects on riparian habitat, salmon spawning and migration, and water quality.

New stabilization structures shall be placed landward of the floodway established by FEMA. Hard armoring shall not be authorized unless there is a significant possibility of structural damage within three years.

FEMA – Programmatic Requirements

Streambank stabilization methods include: alluvium placement, vegetated riprap with large wood, log or roughened rock toe, woody plantings, herbaceous cover, deformable soil reinforcement, coir logs, bank reshaping and slope grading, floodplain flow spreaders, floodplain roughness, and engineered log jams, alone or in combination.

Design shall retain natural vegetation and permeable soils and be completed during *Times When Spawning or Incubating Salmonids are Least Likely to be Present in Washington State Freshwaters* (WDFW 2015). Erosion control shall abide by the *Stormwater Management Manual for Western Washington*, as amended by the Washington Department of Ecology.

Vegetated riprap with large wood shall be limited to areas identified as most highly erodible with highest shear stress, and provide compensatory mitigation. At a minimum, the amount of wood incorporated into the treated area shall be equal to the number of whole trees whose cumulative summation of rootwad diameters is equal to 80% of linear-feet of treated streambank or 20% of treated area, whichever is greater. Geotextile fabric should not be used as a filter for riprap or sapping.

Large wood should incorporate intact rootwads, minimally spaced no greater than the average rootwad diameter. Minimum rootwad diameter placed at the toe of structures shall be equal to the bankfull depth, unless availability constrains the project. Space between rootwads may be filled with large boulders, or trimmed or untrimmed woody debris. Boulders should be 1.5 to 2 times the log diameter of adjacent logs, no more than 5 or 6 feet, maximum.

WDFW – Integrated Streambank Protection Guidelines

Guidance for riprap, placement of large woody debris, and rock or wood toe is generally presented in the manual, with emphasis on determining impacts to aquatic habitat and function.

Army Corps of Engineers – Nationwide Permit 13: Bank Stabilization

Banks shall be stabilized with the minimum necessary amount of materials needed for erosion protection, such that no material placed will be eroded by normal or expected high flows. There shall be no more than minimal adverse environmental effects from stabilization. “Stabilization” shall not include stream channelization activities.

Stabilization Alternatives

No Action: If no action is taken, the bank will continue to erode and undermine the parking lot; failure of the parking lot into the stream channel would result in detriment to aquatic habitat and does not meet the objective established by the Issaquah School District.

In-Channel Alterations: In channel alterations to balance the flow energy by artificially dredging an energy sink upstream of the affected bank is not allowed as a stabilization alternative in accordance with FEMA programmatic requirements and Army Corps of Engineers restrictions.

Riprap Armoring: While structurally capable of restoring the bank morphology and minimizing the risk erosion poses to the infrastructure, riprap armoring does not meet the preference of the City of Issaquah for stabilization, nor does it meet the ‘no-net-loss of aquatic habitat function’ requirement from the State of Washington. Riprap armoring does not sufficiently ‘roughen’ the streambank to provide commensurate habitat to what would be lost by minimizing erosion and armoring the bank.

Bioengineered Stabilization: Biotechnical stabilization (plantings) methods alone are not enough to protect against toe erosion caused by jet scour at this site. While woody plantings and herbaceous cover can increase aquatic function and habitat value, a structural solution is necessary to meet the **Technical Design Criteria**. Constraints based on the amount of space between the original OHWM and the undermined parking lot are not enough to account for the 4.3 feet of possible scour at the toe of the cutbank, nor to resist buoyancy and shear forces at the outside edge of the stream meander.

Vegetated Riprap with Large Wood: It is our opinion that the preferred alternative for stabilization which aligns with the requirements of permitting jurisdictions and the objectives of the Issaquah School District is a combination of structural and biotechnical methods. A Schematic Design Plan for this approach is presented in Figure 9. Large woody debris will be placed in a latticed, cribbing structure constructed landward of the original OHWM. Stream boulders and alluvial material will be utilized to reconstruct the eroded bank within the large woody structure, which will have rootwads fronting the channel to recruit sediment and debris, and to provide aquatic habitat value and mitigate the effects of rock placement. To mitigate bed degradation and expected stream incision, the large wood will be placed at a depth of 4.3 feet below the existing channel to prevent future undermining, should the channel continue to incise. It will extend vertically to protect the bank during periods of flooding. Resistance of shear and buoyancy will be addressed with mechanical anchors drilled into the dry bank prior to construction of the large woody debris reinforced bank toe.

Channel erosion will likely continue to occur in the vicinity of the stabilized bank. Particularly, we would expect residual erosive forces to at first affect the southwestern cut bank immediately upstream of the stabilized bank. It is also possible for the erosive power of the jet scour targeted at the subject bank to move downstream of the anchoring point of the stabilization and repair. The Army Corps of Engineers ‘Hydrologic Engineering Center’s River Analysis System’ (HEC-RAS) software was utilized to calculate flow and analyze sediment transport models. Calculations are presented in **Appendix C**. Based on our preliminary assumptions, the proposed vegetated riprap with large woody debris bank treatment will not result in substantial impacts to the base flood storage capacity on neighboring sites.

Design Guidance

Anchor Points and Extent of Stabilization: It is critical that the bank repair and stabilization area encompass portions of the bank most susceptible to high shear forces and local scour, with the understanding that stabilizing the entire streambank within the property may redirect some scour downstream. Natural anchor points shown on the Schematic Design Plan in Figure 9 are boundary points encompassing the minimum necessary area of the bank both affected by ongoing scour and posing the highest level of risk to infrastructure. The resultant minimum extent of stabilization and bank treatment is approximately 110 linear feet. Streambank modifications shall only occur landward of the prior floodway boundary indicated on the survey established by FEMA on the FIRM panel dated August 19, 2020. The prior floodway boundary in the vicinity of the subject area represents the edge of water prior to the 2020 flooding and subsequent scour.

Construction Considerations: Excavations adjacent to the bank will be required in order to place the large woody debris at sufficient depth to prevent future scour from undermining the installation. At present, the edge of water intersects the proposed bank reconstruction area, even during low-flow portions of the year. Any bank stabilization work in the vicinity of Issaquah Creek must only occur during the WDFW ‘fish window’. Since bank stabilization will only occur landward of the prior floodway boundary, the primary stream channel should remain accessible during construction and a temporary bypass of the stream reach will not be necessary due to the anticipated limited disturbance of the channel for the installation.

We estimate the stream stage during the ‘fish window’ to require partial, temporary barriers of less than 3.0 feet of water at the time of construction. Temporary cofferdam plans shall be developed by the contractor and reviewed by NGA prior to construction. Sandbags with an impermeable liner, water-filled bags or tubes, or collapsible, portable, fabric membranes could be used as temporary water diversion methods for the cofferdam.

Sheet piles may be used if necessary, depending on construction access requirements and hazards. If used, sheet piles shall be designed in accordance with WSDOT standard specification 2-09.3 (3) Section D. In any case, we recommend any temporary cofferdam be installed a minimum of 12-inches above the deepest water surface elevation along the cofferdam alignment associated with the recent 2-week high stage of the stream to prevent overflow flooding in the work area.

Temporary dewatering landward of the partial cofferdam within the work area shall occur in accordance with Element 10 of the SWPPP requirements section outlined in Volume I Chapter 3 of the 2019 Stormwater Management Manual for Western Washington, by the Washington State Department of Ecology. Discharge of water back into Issaquah Creek shall be downstream of the work area and limited to only clean, non-turbid waters. Pump intakes shall be screened at all times. Discharge shall only occur in a manner that does not cause erosion or flooding of downstream waters. Highly turbid waters shall be detained and treated with an appropriate Best Management Practice (BMP), such as a portable treatment unit, sand filters, and flocculants for the duration of the temporary dewatering. After temporary, partial diversion is achieved, the contractor and/or project biologist should remove any stranded fish.

Erosion control methods and temporary dewatering should be observed by a Certified Erosion and Sediment Control Lead (CESCL), which can be staffed by representatives of NGA during construction. BMPs should be used to control erosion before, during, and after construction occurs. For example, stockpiles should be covered during inclement weather, and storm grates should include removable sediment traps. Careful consideration by the contractor should be made prior to construction to ensure placement and staging of materials does not impact the streambank. NGA should review a Temporary Erosion and Sediment Control (TESC) plan prior to construction.

Shoring and Temporary Excavations: Temporary cut slope stability is a function of many factors, including the type and consistency of soils, depth of the cut, surcharge loads adjacent to the excavation, length of time a cut remains open, and the presence of surface or groundwater. It is exceedingly difficult under these variable conditions to estimate a stable, temporary, cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe slope configurations at all times as indicated in OSHA guidelines for cut slopes.

The following information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Nelson Geotechnical Associates, Inc. assumes responsibility for job site safety. Job site safety is the sole responsibility of the project contractor.

It is our opinion that the recently installed temporary steel sheet pile stabilization method may be able to be used to support temporary cut excavations around the proposed permanent repair, and that decommissioning of the temporary stabilization should occur incrementally during the installation of the permanent structures. For planning purposes, we recommend that temporary cuts in the upper undocumented fill and alluvial soils be no steeper than 2.5 Horizontal to 1 Vertical (2.5H:1V). If significant groundwater seepage or surface water flow were encountered, we would expect that flatter inclinations would be necessary. If temporary cut excavations are not able to achieve the above recommended inclinations, we should be retained during construction to collaborate on temporary shoring solutions with the contractor.

Large Woody Debris (LWD): LWD shall be competent, not rotten, and in good condition. Large branches and tangled roots are preferred and should not be trimmed if possible. LWD and rootwads shall be utilized from live trees and shall have a minimum of 30 feet of tree stem including the rootwad unless otherwise noted on the Schematic Design Detail in Figure 10. Depending on sources of LWD, logs may need to be cut into pieces for transport then reassembled on-site by splicing, gluing, and tacking the pieces back together. In accordance with FEMA programmatic requirements, the summation of rootwad diameters utilized for the project must equal 129 linear feet. Therefore, the minimum amount of large woody debris with rootwads is 16 pieces with 12-foot diameter rootwads, or 24 pieces with 8-foot diameter rootwads. All logs shall have a minimum diameter at breast height (DBH) of 18 inches. All LWD shall have a minimum diameter of 10 inches at the small, tapered end unless otherwise noted. LWD shall only consist of Douglas fir (*Pseudotsuga menziesii*) and/or western redcedar (*Thuja plicata*), unless otherwise approved by NGA and the project biologist. We recommend each LWD piece be evaluated by NGA prior to transport to the site for staging. Long logs should be trimmed on site to be situated as close as possible against the steep bank, sharpened and pressed into the bank where possible as well.

Placement of Fill: Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures might include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction.

The area to receive the fill should be suitably prepared prior to beginning fill placement. Excavations should make terraced, flat cuts and exposed subgrades should be maintained in a semi-dry condition. The contractor should plan to limit machinery from sensitive areas where possible, and/or plan for impacts related to machinery in proximity to the creek. We anticipate impacts could be limited by using large excavators with arm extensions and flat buckets to complete site grading, and/or a boom truck or crane situated in the parking area above the creek to install and situate the large woody debris and heavy rock.

Since wet conditions are likely to be encountered, special site stripping and grading techniques might be necessary. It may be necessary to cover exposed subgrades with a layer of crushed rock for protection. When wet conditions are encountered, the subgrade should not be compacted as this could cause further subgrade disturbance. In wet conditions, it may be necessary to cover the exposed subgrade with a layer of crushed rock as soon as it is exposed to protect the moisture sensitive soils from disturbance by foot traffic during construction. Surface water and seepage should be diverted around prepared subgrade.

In general, all filling should be accomplished in uniform lifts up to eight inches thick. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts. All structural fill underlying building areas and pavement subgrade should be compacted to a minimum of 95 percent of its maximum dry density. Maximum dry density, in this report, refers to that density as determined by the ASTM D-1557 Compaction Test procedure. The moisture content of the soils to be compacted should be within about two percent of optimum so that a readily compactable condition exists. It may be necessary to over-excavate and remove wet soils in cases where drying to a compactable condition is not feasible. All compaction should be accomplished by equipment of a type and size sufficient to attain the desired degree of compaction and should be tested.

Rock Requirements: *'Fish Mix Gravel'* shall consist of washed, round fluvial (river) gravel consisting by volume of 60% sand to 2-inch diameter rock, in accordance with WSDOT standard specification 9-03.11 section (1), 20% 2- to 6-inch diameter rock, and 20% 6- to 18-inch diameter rock per section (2). *'Fish Mix'* shall be supplemented as necessary with native bed material and/or imported pit run in order to match existing bed material gradation and prevent subsurface flow.

Anchor *'Habitat Boulders'* shall be 2, 3, and 4-man rock in accordance with WSDOT specifications and indicated on the Schematic Design Detail in Figure 10. Streambed cobbles and boulders shall meet WSDOT standard specification 9-03.11 Sections (2) and (3). Large anchor rocks shall be sourced from a naturally occurring fluvial sediment and shall thus be rounded or semi-rounded as possible.

'Riprap' should meet WSDOT standard specification 9-13.1 (2) for light loose rip rap, and quarry spalls should meet WSDOT standard specification 9-13.6.

Tieback Anchors: Tieback anchors will secure the large woody debris to the undisturbed bank to prevent loss and impacts during future flooding events. As shown on the Schematic Design Detail in Figure 10, two sets of anchors will be utilized to secure the placement of the large woody debris. One set of anchors will be near the outboard face of the woody debris and oriented directly downward to redundantly counteract buoyancy forces on the structure. Another set will be situated at a downward angle into the bank and secure the back of the woody debris as a precautionary measure in the event the sharpened ends of anchor logs are unable to be appropriately pressed into the bank.

The contractor should determine the torque values required to achieve the desired capacity. Load carrying capacities on the order of 10 kips or more could be achieved using a triple-helix with 8-, 10-, and 12-inch diameter anchor installed successfully. However, the anchors should advance a minimum of 20 feet into undisturbed soils to achieve sufficient capacities. The helical anchors should be installed as recommended by the supplier using torque levels correlating the desired capacities. Anchors should be spaced a minimum of three times the diameter of the largest helix of the anchor on center. We recommend that we review proposed anchor installation methods from the contractor. We should also observe anchor installation and testing.

Two anchors should be performance tested to 200 percent of the anchor design capacity. The performance test should consist of cyclic loading in increments of 25 percent of the design load, as outlined in the Federal Highways Administration (FHA) report No. FHWA/RD-82/047. The test location should be determined in the field, based on soil conditions observed during anchor installation.

Cabling: Anchorage shall be fastened using 5/8" minimum diameter galvanized or stainless-steel cable, or hot-dip galvanized 5/8" diameter steel chain as indicated on the Schematic Design Detail in Figure 10. Notches a minimum of 1-inch in depth should be made on large woody debris for cable placement. All chain and cable shall be fastened with hot-dip galvanized steel clamps and liberal quantities of hot-dip galvanized 3/8" x 4" steel staples. Epoxy used for anchorage should consist of Hilti HIT-HY 150 resin adhesive or equal.

Vegetation and Restoration: Revegetation shall be completed with native riparian species to be determined by the project biologist and in accordance with prevailing jurisdictional requirements. Density and timing of restoration plantings should also be coordinated by the project biologist. Consideration should be made for plants compatible with the climate of the planting site, reasonable availability, probability of successful establishment, and ability to meet targets for biodiversity and habitat which may be associated with various stakeholder and jurisdictional requirements. In any case, watering and maintenance recommendations for plantings should be supplied by the project biologist to the Owner to ensure successful establishment of the revegetation over a three-year period, consistent with the **Technical Design Criteria** subsection of this project.

Degradable, all-natural coconut coir matting or jute netting should be installed on restoration areas prior to planting, and this erosion control surfacing staked with 18- to 24-inch long, wedge-shaped stakes made by cutting untreated 2x4s diagonally. Stakes should be placed in regular intervals no greater than three feet on-center, and erosion control fabric should incorporate an overlap of at least a foot in restoration areas. We do not recommend synthetic reinforcement mats at this site to prevent microplastic debris from entering Issaquah Creek as a result of this bank stabilization and habitat restoration project. Metal stakes and/or staples or small wooden pegs for tacking erosion control fabrics are similarly incompatible with desired outcomes for the project.

Monitoring Requirements

Construction Monitoring: NGA should be retained to monitor installation and construction of the permanent bank repair at this site. Specifically, we should review TESC plans and temporary partial dewatering plans developed by the selected contractor. During construction, we should review the import of large woody debris to the site, and selection of various rock as fill. We recommend we be present to observe construction of temporary partial dewatering, excavations, tieback anchor installation, large woody debris placement, rock placement, anchorage, and fill on a full-time basis. We should be retained part-time during construction to observe restoration, replanting, and erosion control.

Ongoing Monitoring: Monitoring of the project after construction shall be in accordance with programmatic requirements by FEMA and those of the Army Corps of Engineers. Specifically, we recommend monitoring be conducted during or following 2-year or higher flow events for a minimum of five years following project completion. Loose LWD should be re-anchored, and damage should be assessed during these visits. Hydrologic impacts of the project should be measured periodically within the five-year monitoring period.

Monitoring should result in measurable outcomes to determine project success, as outlined in the **Technical Design Criteria** subsection of this report. Specifically, upstream and downstream geomorphic impacts should be monitored with cross sectional surveys annually during low-flow periods. Video should be recorded to observe local flow patterns during high-flow events. Habitat monitoring should consider percent cover or shading of the stream over time, and plant-survival rate. A summary of recommended long-term monitoring activities is presented in Table 4 below.

Table 4 – Recommended Long-Term Monitoring Program

Monitoring Goal	Metric	Monitoring Frequency	Timing
<ul style="list-style-type: none">• Local Impacts• LWD Remains In-Tact	<ul style="list-style-type: none">• Qualitative geomorphic observations• Measured Cross Sections	Annually, Five Years	Early Low- Flow Event
<ul style="list-style-type: none">• 60% Plant Survival• 80% Plant Coverage	<ul style="list-style-type: none">• Planting Survey	Annually, Three Years	Growing Season End
<ul style="list-style-type: none">• Stability during High Flow• High Flow Hydrology	<ul style="list-style-type: none">• Video Records• Qualitative geomorphic observations	As needed, Five Years +	>2-year High- Flow Events

USE OF THIS REPORT

NGA has prepared this report for the Issaquah School District and associated agents, for use in the planning and design of the development on this site only. Our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions. The scope of our work does not include services related to other geologic hazards beside Channel Migration Hazards. There are possible variations in subsurface conditions between the explorations and also with time. The variability in earth materials in the vicinity of the site can influence bank erosion rates and susceptibility. Unforeseen changes in watershed conditions could alter sediment and woody debris inputs upstream of the property, changing predictions of future aggradation. Climate-change impacts will influence the magnitude and frequency of peak flows; more frequent and/or more intense flood events may increase rates of channel migration and erosion at this site.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this report was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

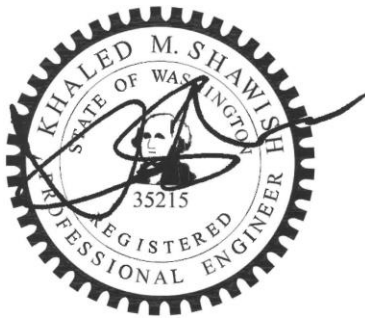
It has been a pleasure to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Carston T. Curd

Carston T. Curd, GIT
Project Geologist



Khaled M. Shawish, PE
Principal

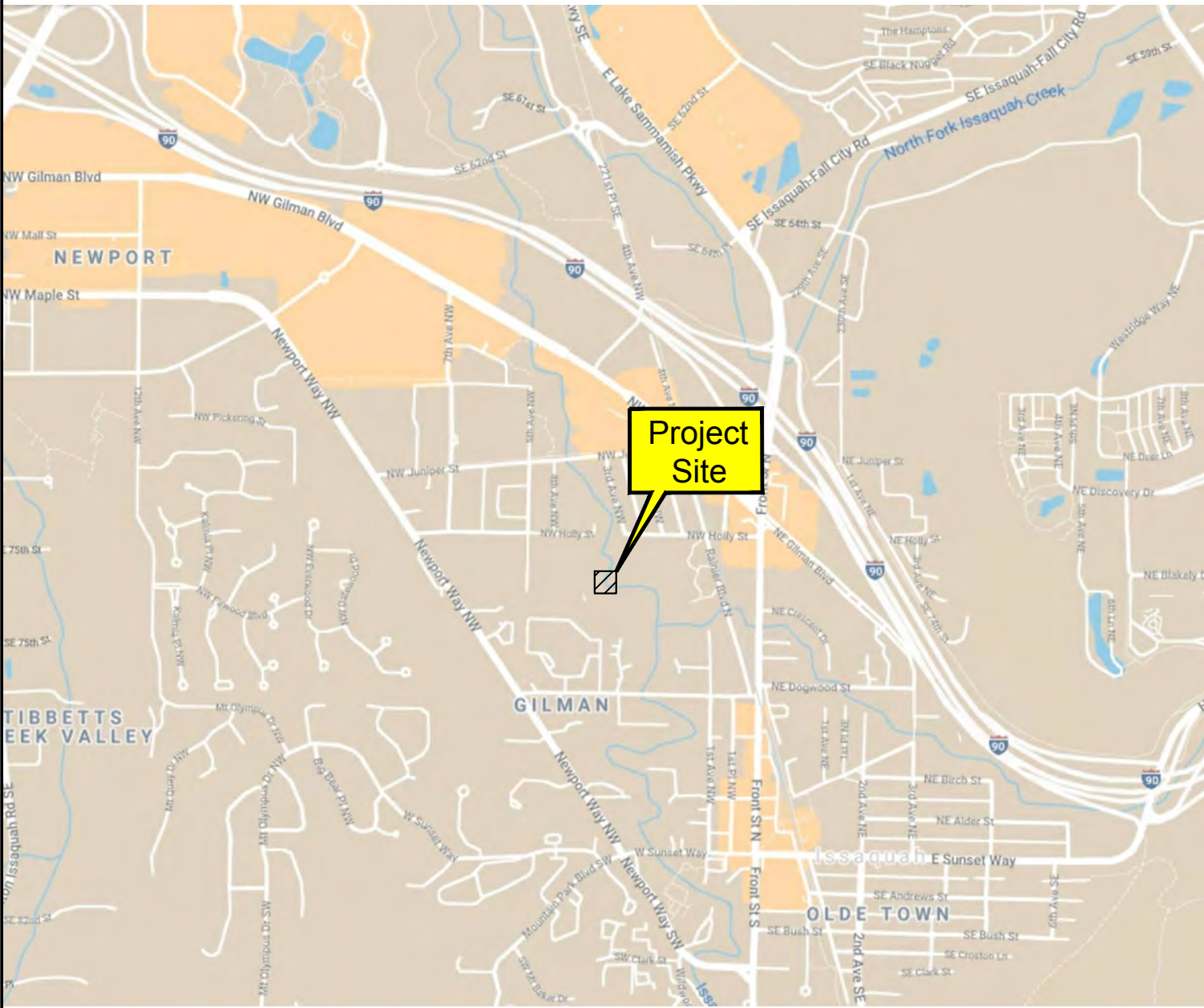
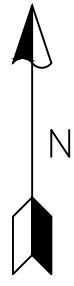
CTC:KMS:ctc

Appendices A, B, C and Ten Figures Attached

NELSON GEOTECHNICAL ASSOCIATES, INC.

VICINITY MAP

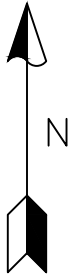
Not to Scale



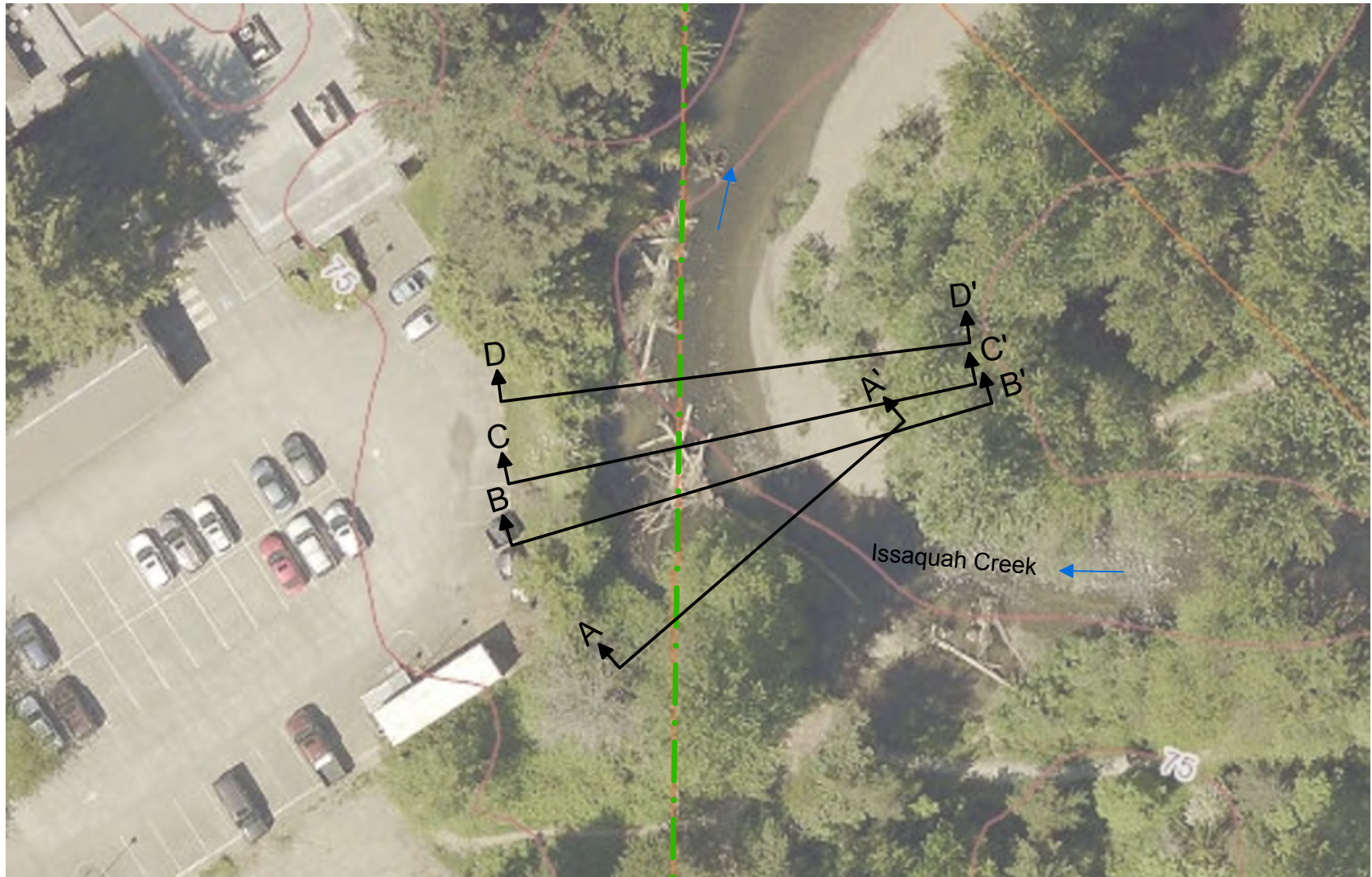
Issaquah, WA

Project Number 1228720	Issaquah Creek Bank Stabilization Vicinity Map	 NELSON GEOTECHNICAL ASSOCIATES, INC <small>Woodinville Office 17311-135th Ave. NE, A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510 www.nelsongeotech.com</small> <small>Wenatchee Office 105 Palouse St Wenatchee, WA 98801 (509) 665-7696 / Fax: 665-7692</small>	No.	Date	Revision	By	CK
Figure 1			1	7/13/21	Original	DPN	CTC

\\hillcompany\2020 NGA Project Folders\12287-20 Issaquah School District Holly Street Bank Stabilization\Drafting\VM.dwg



Schematic Site Plan



LEGEND



Property line



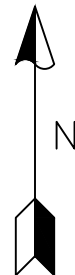
Approximate location
of cross-section



Approximate Scale: 1 inch = 40 feet

Reference: Site plan based on field measurements, observations, and aerial parcel map review.

Project Number 1228720	Issaquah Creek Bank Stabilization Schematic Site Plan	 NELSON GEOTECHNICAL ASSOCIATES, INC. Woodville Office 17311 135th Ave NE A-500 Woodinville, WA 98072 (425) 485-1699 / Fax: 481-2510 Westlake Office 105 Palouse St Westlake, WA 98091 (509) 665-7695 / Fax: 665-7692	No. 1	Date 7/13/21	Revision Original	By DPN	CK CTC
Figure 2							

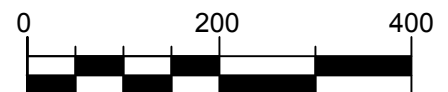


LiDAR Site Plan



LEGEND

- . - Property line



Approximate Scale: 1 inch = 200 feet

Reference: Site plan based on field measurements, observations, and LiDAR map review.

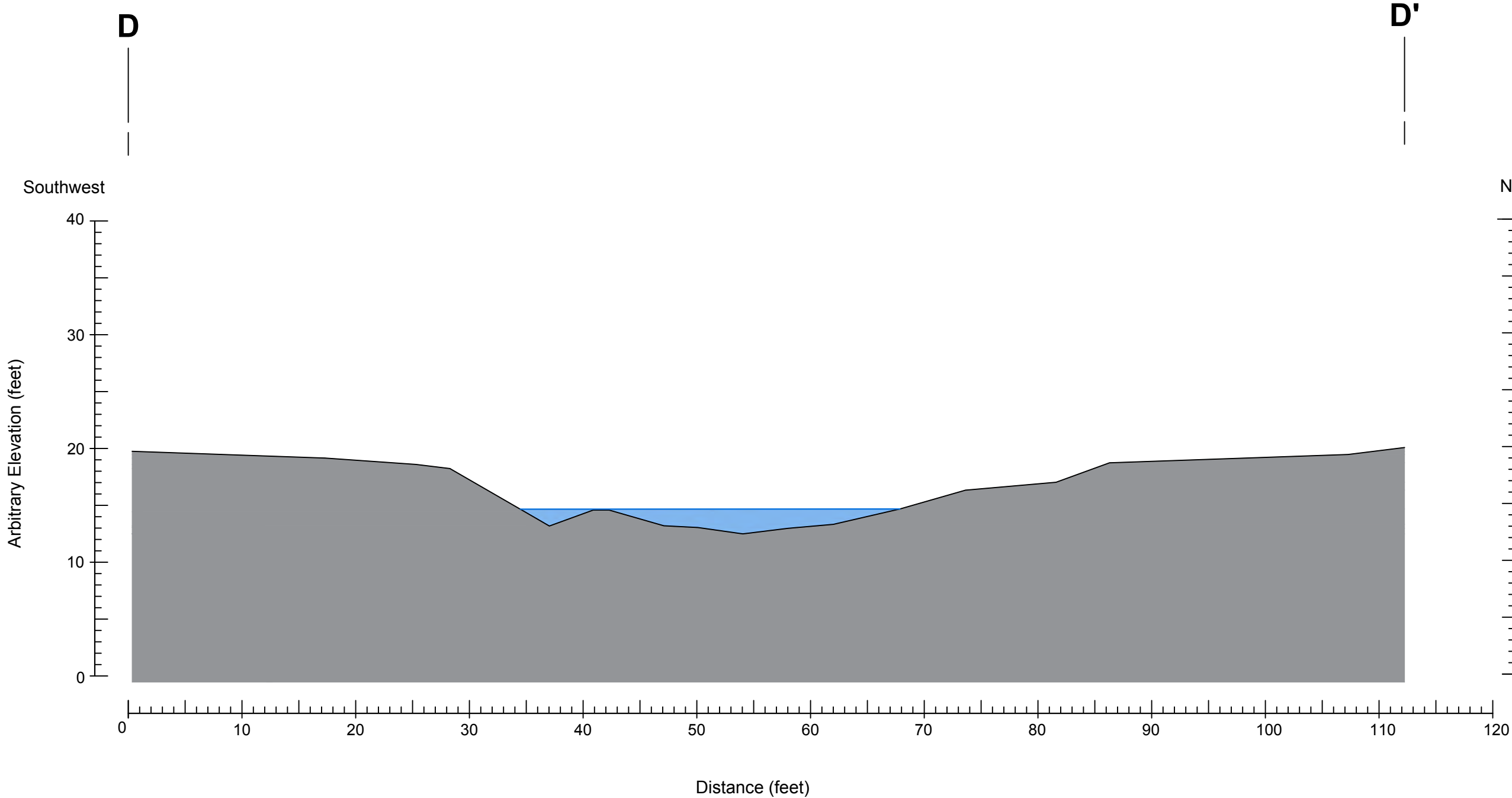
Project Number	Issaquah Creek Bank Stabilization LiDAR Site Plan							
1228720								
Figure 3								

		NELSON GEOTECHNICAL ASSOCIATES, INC.			
Woodville Office 17311-135th Ave. NE, A-500 Woodinville, WA 98072 (425) 485-1669 / Fax: 481-2510 www.nelsongeotech.com		Wenatchee Office 105 Palouse St. Wenatchee, WA 98801 (509) 665-7686 / Fax: 665-7682			
No.	Date	Revision	By	CK	
1	9/8/21	Original	DPN	CTC	

Project Number 1228720	Issaquah Creek Bank Stabilization Cross-Section A-A'	 <p>NELSON GEOTECHNICAL ASSOCIATES, INC</p> <p>Woodinville Office 17311-135th Ave. NE A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510</p> <p>Wenatchee Office 105 Palouse St Wenatchee, WA 98801 (509) 665-7696 / Fax: 665-7692</p> <p>www.nelsongeotech.com</p>	No.	Date	Revision	By	CK
			1	7/13/21	Original	DPN	CTC

Project Number 1228720	Issaquah Creek Bank Stabilization Cross-Section B-B'	 <p>NELSON GEOTECHNICAL ASSOCIATES, INC</p> <p>Woodinville Office 17311-135th Ave. NE A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510</p> <p>Wenatchee Office 105 Palouse St. Wenatchee, WA 98801 (509) 665-7696 / Fax: 665-7692</p> <p>www.nelsongeotech.com</p>	No.	Date	Revision	By	CK
			1	7/13/21	Original	DPN	CTC

Project Number 1228720	Issaquah Creek Bank Stabilization Cross-Section C-C'	 <p>NELSON GEOTECHNICAL ASSOCIATES, INC</p> <p>Woodinville Office 17311-135th Ave. NE A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510</p> <p>Wenatchee Office 105 Palouse St Wenatchee, WA 98801 (509) 665-7696 / Fax: 665-7692</p> <p>www.nelsongeotech.com</p>	No.	Date	Revision	By	CK
			1	7/13/21	Original	DPN	CTC



- NOTES:
- 1) Stratigraphic conditions are interpolated between the explorations. Actual conditions may vary.
 - 2) Elevations are arbitrary.

Reference: Cross Section is based on field measurements using a hand-held clinometer and 100-ft tape measure.



NELSON GEOTECHNICAL ASSOCIATES, INC

Woodinville Office
17311-135th Ave., NE, A-500
Woodinville, WA 98072
(425) 486-1669 / Fax: 481-2510
www.nelsongeotech.com

Wenatchee Office
105 Palouse St.
Wenatchee, WA 98801
(509) 665-7696 / Fax: 665-7692

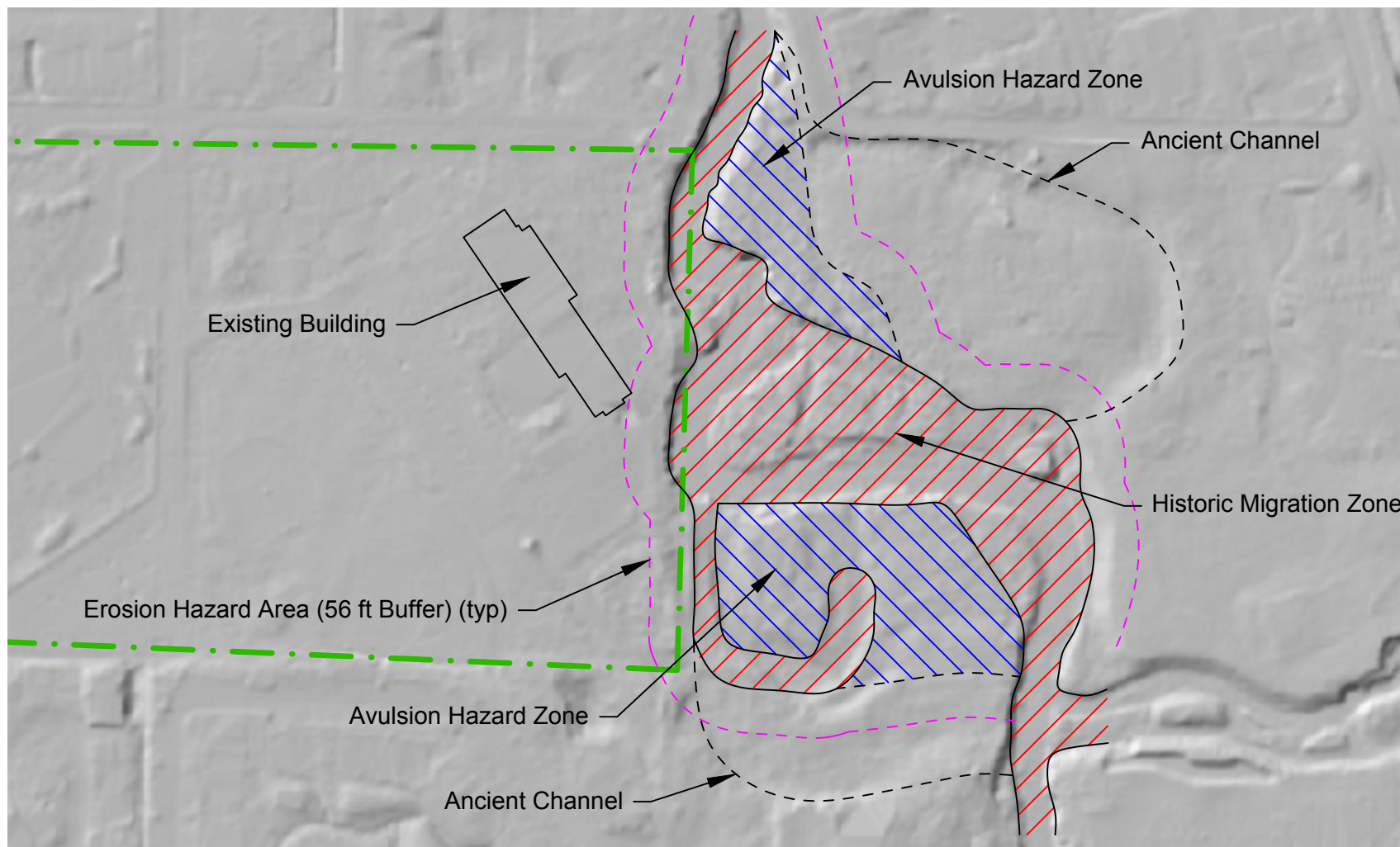
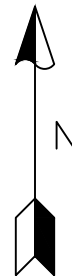
Issaquah Creek Bank
Stabilization
Cross-Section D-D'

Project Number
1228720

Figure 7

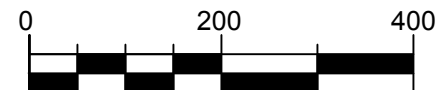
No.	Date	Revision	By	CK
1	7/13/21	Original	DPN	CTC

Channel Migration Hazard Delineation



LEGEND

— · — · — Property line



Approximate Scale: 1 inch = 200 feet

Reference: Site plan based on field measurements, observations, and LiDAR map review.

Project Number 1228720	Issaquah Creek Bank Stabilization	 NELSON GEOTECHNICAL ASSOCIATES, INC. <small>Woodinville Office 17311 135th Ave NE A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510</small> <small>Westlake Office 105 Pavilion St Westlake, WA 98091 (509) 665-7686 / Fax: 665-7682</small>	No.	Date	Revision	By	CK
Figure 8	Channel Migration Hazard Delineation		1	9/8/21	Original	DPN	CTC

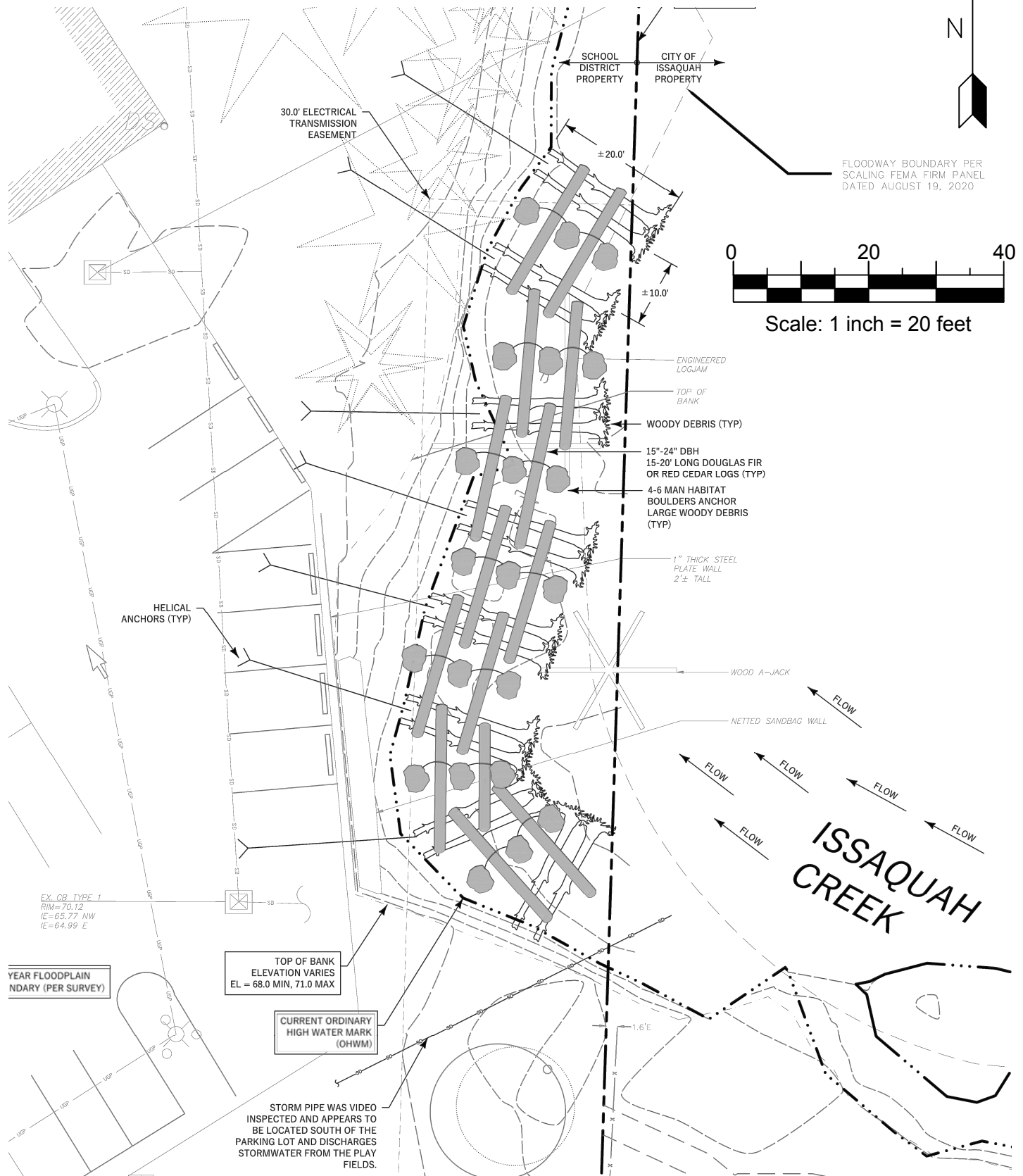
Design Plan



FLOODWAY BOUNDARY PER
SCALING FEMA FIRM PANEL
DATED AUGUST 19, 2020



Scale: 1 inch = 20 feet

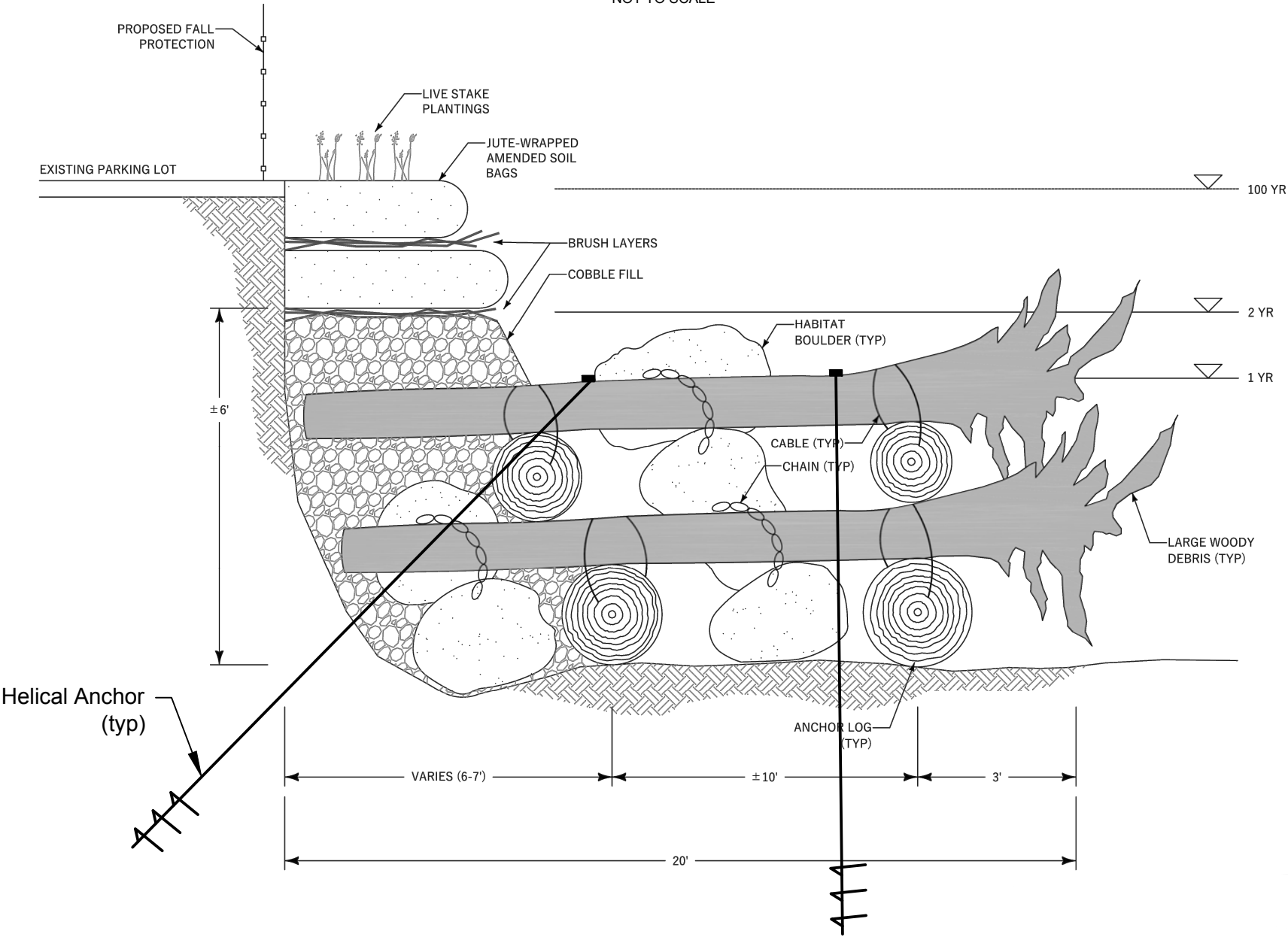
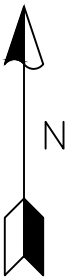


Reference: Design Plan based on a plan dated September 3, 2021 titled "IDS Holly Street Campus Permanent Creek Repair," provided by the Issaquah School District.

Project Number 1228720	Issaquah Creek Bank Stabilization Design Plan	 NELSON GEOTECHNICAL ASSOCIATES, INC Woodinville Office 17311-135th Ave. NE, A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510 www.nelsongeotech.com	Wenatchee Office 105 Palouse St Wenatchee, WA 98801 (509) 665-7696 / Fax: 665-7692	No.	Date	Revision	By	CK
Figure 9				1	9/8/21	Original	DPN	CTC

Schematic Design Section

NOT TO SCALE



Helical Anchor (typ)

VARIES (6-7')

± 10'

3'

20'

ANCHOR LOG (TYP)

LARGE WOODY DEBRIS (TYP)

CABLE (TYP)

CHAIN (TYP)

HABITAT BOULDER (TYP)

BRUSH LAYERS

COBBLE FILL

LIVE STAKE PLANTINGS

JUTE-WRAPPED AMENDED SOIL BAGS

EXISTING PARKING LOT

PROPOSED FALL PROTECTION

Project Number
1228720
Figure 10

Issaquah Creek Bank
Stabilization
Schematic Design Section



Woodville Office
17311 135th Ave NE A-500
Woodinville, WA 98072
(425) 485-1669 / Fax: 481-2510

Westlake Office
105 Pioneer St
Westlake, WA 98071
(509) 665-7686 / Fax: 665-7682

NELSON GEOTECHNICAL ASSOCIATES, INC

No.	Date	Revision	By	CK
1	9/8/21	Original	DPN	CTC

Reference: Design Plan based on a plan dated September 3, 2021 titled "IDS Holly Street Campus Permanent Creek Repair," provided by the Issaquah School District.

Appendix A: Glossary

Aggradation	An increase in land elevation due to the deposition of sediment
AHZ	Avulsion Hazard Zone: the part of the CMZ where the channel may shift suddenly
Alluvial	Sediment deposited by flowing water or landforms resulting from that type of deposition
Amplitude	A measurement of the maximum, opposite extent of stream meanders
Anthropogenic	Originating in human activity
Avulsion	The process where the stream suddenly shifts to a new channel location
Bankfull Conditions	The width and depth of the active channel at the stage when water just begins to overflow into the active floodplain or bench
Bed Load Transport	The largest of particles transported by stream activity that move along the ground surface by rolling, sliding, or jumping
Channel Migration	The movement of a stream channel back and forth across its valley
CMZ	Channel Migration Zone: for the purposes of this report, the area where the channel may be reasonably predicted to migrate over the 75-year life of the proposed residence
Cutbank	High energy outside bank of a water channel or meander forming a near-vertical bank subject to erosion
EHA	Erosion Hazard Area: the area where future bank erosion is likely
Floodplain	Areas inundated by flood flows
Geomorphic	Having to do with the shape of the earth surface or processes that formed those shapes
HMZ	Historic Migration Zone: the area where the river channel has migrated since approximately 1936
LiDAR	Light Detection and Ranging: remote sensing method using pulsed lasers to precisely measure the surface of the earth
Point Bar	Low energy inside bank of a water channel or meander forming a gentle terrace and subject to aggradation and/ or periodic inundation
Reach	A further section of a segment in the context of watershed mapping
Relic	Surviving remnant of a natural phenomenon, in the context of this study, channel features which are no longer actively conveying surface water
River Miles (RM)	Measurement of distance upstream of the confluence of Issaquah Creek with Lake Sammamish at Lake Sammamish State Park
River Stage	Water level above an arbitrary point measured in feet
Segment	Portion of the watershed subject to study based on similar valley confinement, discharge, channel pattern, and valley gradient ranging from several hundred feet to several miles in length
Stratigraphy	The order and relative position of geologic earth materials
Thalweg	An imaginary line connecting the lowest points of cross sections of a valley or stream
USGS	United States Geological Survey

APPENDIX B

Subsurface Exploration Logs by Others

*Associated Earth Sciences, Inc. (AESI) – “Issaquah Creek Bank Erosion Repair,” dated July 9, 2020
Site Plan, Borehole Log, CPT Log (3 Plates)*

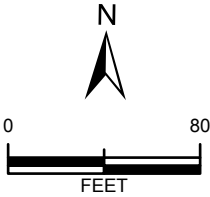
\\kirkfile2\GIS\GIS_P\Projects\aa\Y2018\180066 Issaquah Middle School\mxd\E002\180066E001 F1 F2



- APPROXIMATE AREA OF TEMPORARY EROSION REPAIR
- CREEK BANK EXPOSURE RESULTING FROM 2020 FLOODS
- EXPLORATION BORING (1999)
- EXPLORATION BORING (2018)
- EXPLORATION PIT (2017)
- MONITORING WELL (2018)
- CONE PENETROMETER (2018)
- PARCEL

DATA SOURCES / REFERENCES:
KING CO: STREETS, PARCELS, PARKS 3/20, STREAMS 1/18
AERIAL PICTOMETRY INT. 2019

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE



BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION



EXISTING SITE AND EXPLORATION PLAN

HOLLY STREET CAMPUS - CREEK BANK EROSION
ISSAQUAH, WASHINGTON

PROJ NO. 20180066E002	DATE: 7/20	FIGURE: 2
--------------------------	---------------	--------------



associated
earth sciences
incorporated

Exploration Log

Project Number
180066E001

Exploration Number
EB-2

Sheet
1 of 2

Project Name Issaquah Middle School

Location Issaquah, WA

Driller/Equipment Boretac / EC95 Rubber Track Drill

Hammer Weight/Drop 140# / 30"

Ground Surface Elevation (ft) _____

Datum N/A

Date Start/Finish 4/30/18, 4/30/18

Hole Diameter (in) 8 inches

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot				Other Tests
								10	20	30	40	
				Gravel Fill								
5		S-1		Very moist, grayish brown, fine SAND, some silt, some gravel (SP).			2 1 2	▲3				
		S-2		Moist, gray, fine sandy, SILT; faintly laminated with rust colored laminae (ML). Younger Alluvium Moist, orangish brown, medium SAND, some silt, some gravel (SP).			7 6 5	▲11				
10		S-3		Wet, brown, silty, fine SAND, some gravel (SM). Wet, orangish brown, slightly sandy, GRAVEL, some silt (GP). Free water in spoon. Some drill chatter.		▼	12 13 12		▲25			
15		S-4		Wet, brown, fine SAND (SP). Wet, brownish gray, coarse SAND, some gravel (SP). Wet, brownish gray, silty, gravelly, fine SAND (SM).			14 13 13		▲26			
				Fraser Undifferentiated Heavy drill chatter, bouncing. Difficult drilling.								
20		S-5		Wet, brownish gray with trace iron oxide staining, very gravelly, slightly silty, medium SAND; occasional large gravel in spoon; interbeds (<1 inch thick) of coarse sand or silt (SP). Difficult drilling continues.			14 21 27					▲48
25		S-6		Wet, brownish gray, very gravelly, medium SAND, some silt; thin beds (1/2 to 1 inch thick) of coarse sand and silt (SP). Smoother drilling.			20 26 22					▲48
30		S-7		Wet, gray, fine SAND; massive; grades to medium SAND with gravel at shoe (SP). Difficult drilling.			7 7 7	▲14				
35		S-8		Wet, gray, fine SAND; massive (SP). Wet, brownish gray, sandy, GRAVEL, some silt; clasts of gray silt and brown silt (GP). Smoother drilling.			11 20 23					▲43

Sampler Type (ST):



2" OD Split Spoon Sampler (SPT)



3" OD Split Spoon Sampler (D & M)



Grab Sample



No Recovery



Ring Sample



Shelby Tube Sample

M - Moisture

▼ Water Level ()

▼ Water Level at time of drilling (ATD)

Logged by: NS

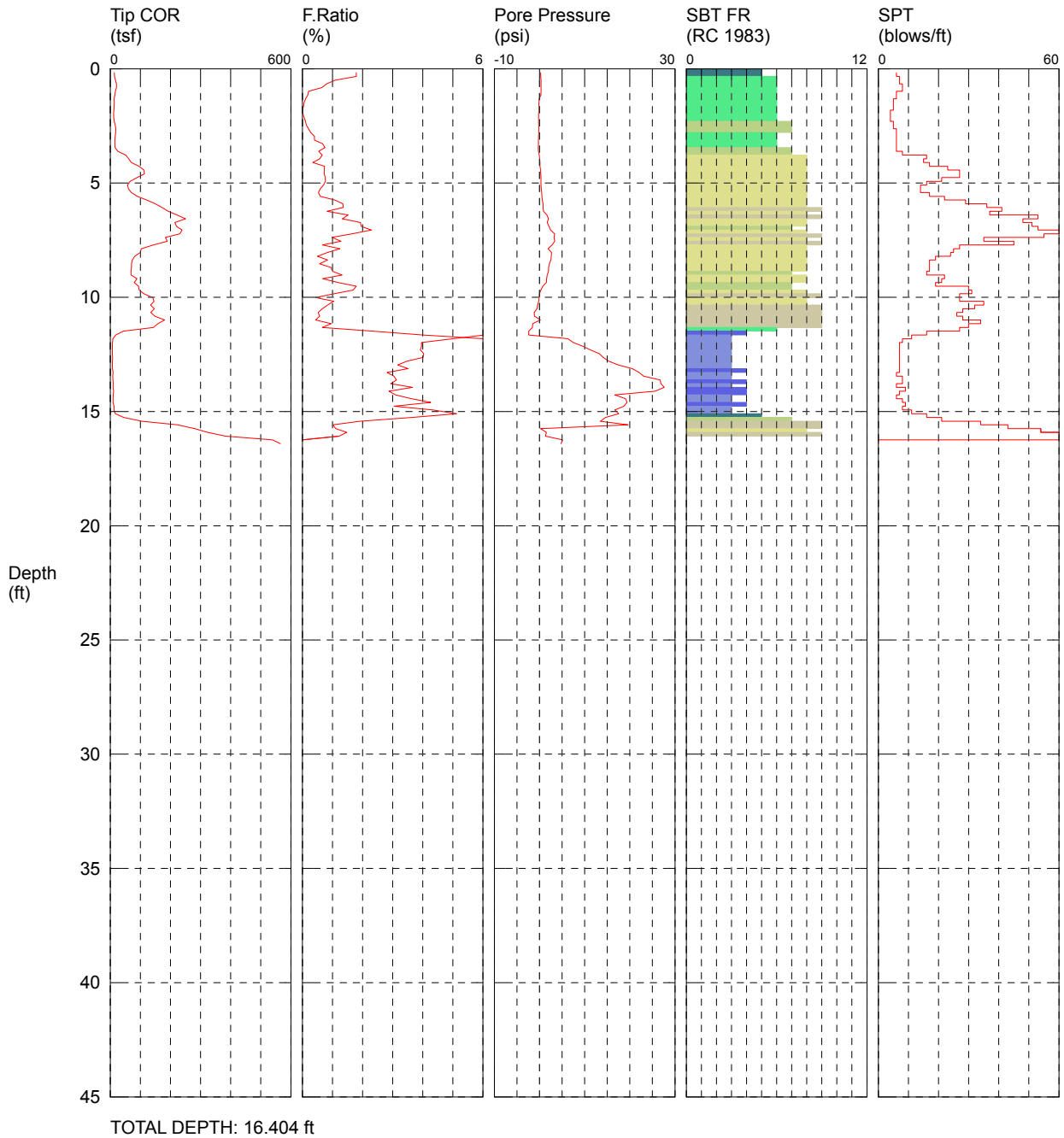
Approved by: CJK



CPT-06

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: AESI
LOCATION: Issaquah
JOB NUMBER: 180066E001
COMMENT: Issaquah Mid School Admin Site

OPERATOR: Okbay
CONE ID: DDG1263
TEST DATE: 4/23/2018 1:19:59 PM
PRIDRILL: N/A
BACKFILL: Bentonite Chips
SURFACE PATCH: Bentonite Chips



- | | | | |
|--------------------------|-----------------------------|----------------------------|--------------------------------|
| 1 sensitive fine grained | 4 silty clay to clay | 7 silty sand to sandy silt | 10 gravelly sand to sand |
| 2 organic material | 5 clayey silt to silty clay | 8 sand to silty sand | 11 very stiff fine grained (*) |
| 3 clay | 6 sandy silt to clayey silt | 9 sand | 12 sand to clayey sand (*) |

*SBT/SPT CORRELATION: UBC-1983

APPENDIX C

Flood Impact Analyses

US Army Corps of Engineers HEC-RAS 6.0.0

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep

HEC-RAS HEC-RAS 6.0.0 May 2021
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```

X      X  XXXXXX      XXXX      XXXX      XX      XXXX
X      X  X          X      X      X      X      X
X      X  X          X      X      X      X      X
XXXXXXXX XXXX      X      XXX XXXX      XXXXXX      XXXX
X      X  X          X      X      X      X      X
X      X  X          X      X      X      X      X
X      X  XXXXXX      XXXX      X      X      X      XXXXX

```

PROJECT DATA

Project Title: Holly Street Existing Conditions - 2021
Project File : HollyStreet2021.prj
Run Date and Time: 9/1/2021 5:16:12 PM

Project in English units

Project Description:

Simple 1D model for a single reach of Issaquah Creek along ISD Holly Street Campus.

PLAN DATA

Plan Title: Plan 01
Plan File : c:\Users\carstonc\Documents\HEC-RAS\HollyStreet2021.p01

Geometry Title: ISDGeometry
Geometry File : c:\Users\carstonc\Documents\HEC-RAS\HollyStreet2021.g01

Flow Title : Flow
Flow File : c:\Users\carstonc\Documents\HEC-RAS\HollyStreet2021.f01

Plan Summary Information:

Number of:	Cross Sections =	5	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep

FLOW DATA

Flow Title: Flow

Flow File : c:\Users\carstonc\Documents\HEC-RAS\HollyStreet2021.f01

Flow Data (cfs)

River	Reach	RS	100 Year
Issaquah Creek	ISD Campus	141	4160
Issaquah Creek	ISD Campus	0	4160

Boundary Conditions

River	Reach	Profile	Upstream
Downstream			
Issaquah Creek	ISD Campus	100 Year	Known WS = 70.29
Known WS = 69.39			

GEOMETRY DATA

Geometry Title: ISDGeometry

Geometry File : c:\Users\carstonc\Documents\HEC-RAS\HollyStreet2021.g01

CROSS SECTION

RIVER: Issaquah Creek

REACH: ISD Campus RS: 141

INPUT

Description:

Station	Elevation	Data	num=	12	Sta	Elev	Sta	Elev	Sta	Elev
0	69	5	69	6	64	10	63	15	62	
29	60	34	60	40	61	46	62	55	63	
66	64	86	67							

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	10	.035	55	.05

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	10	55		34	22	6	.1
							.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	71.34	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.90	wt. n-val.	0.050	0.035
0.050				
W.S. Elev (ft)	70.44	Reach Len. (ft)	34.00	22.00
6.00				

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep				
Crit w.s. (ft)		Flow Area (sq ft)	38.87	408.66
175.05				
E.G. slope (ft/ft)	0.002026	Area (sq ft)	38.87	408.66
175.05				
Q Total (cfs)	4160.00	Flow (cfs)	95.32	3376.06
688.62				
Top width (ft)	86.00	Top width (ft)	10.00	45.00
31.00				
Vel Total (ft/s)	6.68	Avg. Vel. (ft/s)	2.45	8.26
3.93				
Max Chl Dpth (ft)	10.44	Hydr. Depth (ft)	3.89	9.08
5.65				
Conv. Total (cfs)	92424.3	Conv. (cfs)	2117.7	75007.2
15299.4				
Length wtd. (ft)	19.60	Wetted Per. (ft)	15.66	45.46
34.71				
Min Ch El (ft)	60.00	Shear (lb/sq ft)	0.31	1.14
0.64				
Alpha	1.30	Stream Power (lb/ft s)	0.77	9.39
2.51				
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	0.33	1.15
0.51				
C & E Loss (ft)	0.09	Cum SA (acres)	0.08	0.12
0.09				

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: Issaquah Creek
 REACH: ISD Campus RS: 119

INPUT

Description:

Station Elevation Data num= 14									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	70	6	70	9	64	13	63	18	61
22	62	27	62	36	60	50	60	57	62
66	63	86	65	93	66	105	67		

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
0	.05	13	.035	66	.05

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	13	66		27	22	19		.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	71.22	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.61	Wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	70.61	Reach Len. (ft)	27.00	22.00
19.00				
Crit w.s. (ft)		Flow Area (sq ft)	42.93	497.82
217.28				
E.G. slope (ft/ft)	0.001326	Area (sq ft)	42.93	497.82

Page 3

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep

217.28				
Q Total (cfs)	4160.00	Flow (cfs)	84.68	3381.01
694.31				
Top Width (ft)	105.00	Top Width (ft)	13.00	53.00
39.00				
Vel Total (ft/s)	5.49	Avg. Vel. (ft/s)	1.97	6.79
3.20				
Max Chl Dpth (ft)	10.61	Hydr. Depth (ft)	3.30	9.39
5.57				
Conv. Total (cfs)	114240.7	Conv. (cfs)	2325.5	92848.3
19066.9				
Length wtd. (ft)	21.41	wetted Per. (ft)	17.44	54.06
42.82				
Min Ch El (ft)	60.00	Shear (lb/sq ft)	0.20	0.76
0.42				
Alpha	1.30	Stream Power (lb/ft s)	0.40	5.18
1.34				
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	0.30	0.92
0.48				
C & E Loss (ft)	0.02	Cum SA (acres)	0.07	0.10
0.08				

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: Issaquah Creek
 REACH: ISD Campus RS: 97

INPUT

Description:

Station Elevation Data				num=	15				
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	70	5	70	8	67	14	64	15	63
18	61	21	63	40	62	47	61	49	62
55	63	70	64	87	66	98	66	105	67

Manning's n Values				num=	3		
Sta	n Val	Sta	n Val	Sta	n Val		
0	.045	15	.035	55	.045		

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
15	55	36	24	21	.1	.3	

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	71.16	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.84	wt. n-Val.	0.045	0.035
0.045				
W.S. Elev (ft)	70.31	Reach Len. (ft)	36.00	24.00
21.00				
Crit w.s. (ft)		Flow Area (sq ft)	42.70	324.54
266.68				
E.G. Slope (ft/ft)	0.002549	Area (sq ft)	42.70	324.54
266.68				
Q Total (cfs)	4160.00	Flow (cfs)	128.17	2735.11
1296.73				

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep				
Top width (ft)	105.00	Top width (ft)	15.00	40.00
50.00				
Vel Total (ft/s)	6.56	Avg. Vel. (ft/s)	3.00	8.43
4.86				
Max Chl Dpth (ft)	9.31	Hydr. Depth (ft)	2.85	8.11
5.33				
Conv. Total (cfs)	82397.8	Conv. (cfs)	2538.6	54174.7
25684.5				
Length wtd. (ft)	24.41	wetted Per. (ft)	17.68	41.63
53.54				
Min Ch El (ft)	61.00	Shear (lb/sq ft)	0.38	1.24
0.79				
Alpha	1.26	Stream Power (lb/ft s)	1.15	10.46
3.85				
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.28	0.71
0.37				
C & E Loss (ft)	0.05	Cum SA (acres)	0.06	0.07
0.06				

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: Issaquah Creek
 REACH: ISD Campus RS: 73

INPUT

Description:

Station Elevation Data num= 14									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	67	28	65	35	62	37	60	41	62
42	62	47	60	54	59	64	61	68	62
81	64	86	65	93	66	110	67		

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
0	.04	35	.035	68	.045

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	35	68		78	73	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	71.06	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.68	Wt. n-Val.	0.040	0.035
0.045				
W.S. Elev (ft)	70.38	Reach Len. (ft)	78.00	73.00
62.00				
Crit W.S. (ft)		Flow Area (sq ft)	170.64	326.89
225.27				
E.G. Slope (ft/ft)	0.001733	Area (sq ft)	170.64	326.89
225.27				
Q Total (cfs)	4160.00	Flow (cfs)	705.16	2558.34
896.50				
Top width (ft)	110.00	Top width (ft)	35.00	33.00
42.00				
Vel Total (ft/s)	5.76	Avg. Vel. (ft/s)	4.13	7.83

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep

3.98				
Max Chl Dpth (ft)	11.38	Hydr. Depth (ft)	4.88	9.91
5.36				
Conv. Total (cfs)	99933.6	Conv. (cfs)	16939.7	61457.7
21536.2				
Length wtd. (ft)	71.37	wetted Per. (ft)	39.06	35.08
45.73				
Min Ch El (ft)	59.00	Shear (lb/sq ft)	0.47	1.01
0.53				
Alpha	1.33	Stream Power (lb/ft s)	1.95	7.89
2.12				
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	0.19	0.54
0.26				
C & E Loss (ft)	0.08	Cum SA (acres)	0.04	0.05
0.04				

Warning: The cross-section end points had to be extended vertically for the computed water surface.

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Issaquah Creek
 REACH: ISD Campus RS: 0

INPUT

Description: Downstream Cross Section

Station Elevation Data		num= 9									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	68	5	68	11	60	13	59	15	58		
27	58	32	59	40	60	56	62				

Manning's n Values		num= 3			
Sta	n Val	Sta	n Val	Sta	n Val
0	.035	11	.035	40	.045

Bank Sta:	Left	Right	Coeff Contr.	Expan.
	11	40	.1	.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	70.83	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.44	wt. n-Val.	0.035	0.035
0.045				
W.S. Elev (ft)	69.39	Reach Len. (ft)		
Crit w.s. (ft)	66.15	Flow Area (sq ft)	39.29	311.81
134.24				
E.G. Slope (ft/ft)	0.002656	Area (sq ft)	39.29	311.81
134.24				
Q Total (cfs)	4160.00	Flow (cfs)	153.99	3276.25
729.76				
Top width (ft)	56.00	Top width (ft)	11.00	29.00
16.00				
Vel Total (ft/s)	8.57	Avg. Vel. (ft/s)	3.92	10.51
5.44				

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep				
Max Chl Dpth (ft)	11.39	Hydr. Depth (ft)	3.57	10.75
8.39				
Conv. Total (cfs)	80712.4	Conv. (cfs)	2987.8	63565.7
14158.9				
Length wtd. (ft)		wetted Per. (ft)	16.39	29.63
23.51				
Min Ch El (ft)	58.00	Shear (lb/sq ft)	0.40	1.75
0.95				
Alpha	1.26	Stream Power (lb/ft s)	1.56	18.34
5.15				
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

SUMMARY OF MANNING'S N VALUES

River: Issaquah Creek

Reach	River Sta.	n1	n2	n3
ISD Campus	141	.05	.035	.05
ISD Campus	119	.05	.035	.05
ISD Campus	97	.045	.035	.045
ISD Campus	73	.04	.035	.045
ISD Campus	0	.035	.035	.045

SUMMARY OF REACH LENGTHS

River: Issaquah Creek

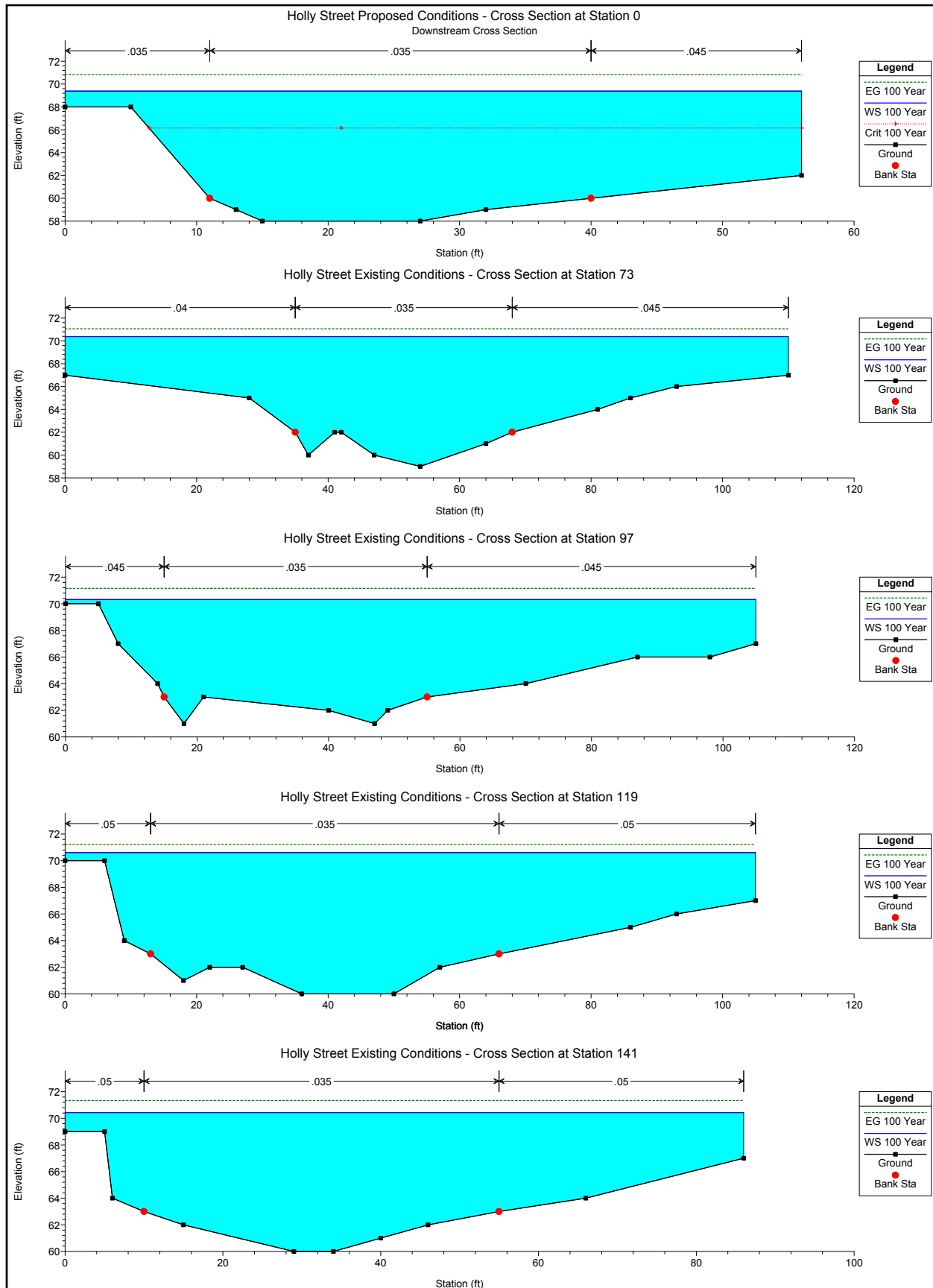
Reach	River Sta.	Left	Channel	Right
ISD Campus	141	34	22	6
ISD Campus	119	27	22	19
ISD Campus	97	36	24	21
ISD Campus	73	78	73	62
ISD Campus	0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Issaquah Creek

Reach	River Sta.	Contr.	Expan.
ISD Campus	141	.1	.3
ISD Campus	119	.1	.3
ISD Campus	97	.1	.3
ISD Campus	73	.1	.3
ISD Campus	0	.1	.3

Appendix C - HEC-RAS Analysis (Existing Conditions)



Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep

HEC-RAS HEC-RAS 6.0.0 May 2021
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```

X      X  XXXXXX      XXXX      XXXX      XX      XXXX
X      X  X          X      X      X      X      X
X      X  X          X      X      X      X      X
XXXXXXXX XXXX      X      XXX XXXX      XXXXXX      XXXX
X      X  X          X      X      X      X      X
X      X  X          X      X      X      X      X
X      X  XXXXXX      XXXX      X      X      X      XXXXX

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PROJECT DATA

Project Title: Holly Street Proposed Conditions
Project File : HollyStreet2021.prj
Run Date and Time: 9/8/2021 9:34:24 AM

Project in English units

Project Description:

Simple 1D model for a single reach of Issaquah Creek along ISD Holly Street Campus with proposed bank reconstruction from a 2019-2020 flood event.

PLAN DATA

Plan Title: Plan 02
Plan File : c:\Users\carstonc\Documents\HEC-RAS\HollyStreet2021.p02

Geometry Title: ISDGeometry (Proposed Conditions)
Geometry File : c:\Users\carstonc\Documents\HEC-RAS\HollyStreet2021.g01

Flow Title : Flow
Flow File : c:\Users\carstonc\Documents\HEC-RAS\HollyStreet2021.f01

Plan Summary Information:

Number of:	Cross Sections =	5	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3
Flow tolerance factor	=	0.001

Computation Options

Critical depth computed only where necessary	
Conveyance Calculation Method:	At breaks in n values only
Friction Slope Method:	Average Conveyance
Computational Flow Regime:	Subcritical Flow

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep

FLOW DATA

Flow Title: Flow

Flow File : c:\Users\carstonc\Documents\HEC-RAS\HollyStreet2021.f01

Flow Data (cfs)

River	Reach	RS	100 Year
Issaquah Creek	ISD Campus	141	4160
Issaquah Creek	ISD Campus	0	4160

Boundary Conditions

River	Reach	Profile	Upstream
Downstream			
Issaquah Creek	ISD Campus	100 Year	Known WS = 70.29
Known WS = 69.39			

GEOMETRY DATA

Geometry Title: ISDGeometry

Geometry File : c:\Users\carstonc\Documents\HEC-RAS\HollyStreet2021.g01

CROSS SECTION

RIVER: Issaquah Creek

REACH: ISD Campus RS: 141

INPUT

Description:

Station	Elevation	Data	num=	12	Sta	Elev	Sta	Elev	Sta	Elev
0	69	5	69	6	64	10	63	15	62	
29	60	34	60	40	61	46	62	55	63	
66	64	86	67							

Manning's n Values

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	10	.035	55	.05

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	10	55		34	22	6	.1
							.3

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	71.37	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.89	wt. n-val.	0.050	0.035
0.050				
W.S. Elev (ft)	70.48	Reach Len. (ft)	34.00	22.00
6.00				

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep				
Crit W.S. (ft)		Flow Area (sq ft)	39.33	410.74
176.48				
E.G. Slope (ft/ft)	0.001988	Area (sq ft)	39.33	410.74
176.48				
Q Total (cfs)	4160.00	Flow (cfs)	96.12	3372.97
690.91				
Top Width (ft)	86.00	Top width (ft)	10.00	45.00
31.00				
Vel Total (ft/s)	6.64	Avg. Vel. (ft/s)	2.44	8.21
3.92				
Max Chl Dpth (ft)	10.48	Hydr. Depth (ft)	3.93	9.13
5.69				
Conv. Total (cfs)	93294.5	Conv. (cfs)	2155.6	75644.1
15494.8				
Length wtd. (ft)	19.04	wetted Per. (ft)	15.71	45.46
34.75				
Min Ch El (ft)	60.00	Shear (lb/sq ft)	0.31	1.12
0.63				
Alpha	1.30	Stream Power (lb/ft s)	0.76	9.21
2.47				
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	0.27	1.04
0.50				
C & E Loss (ft)	0.03	Cum SA (acres)	0.08	0.12
0.09				

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: Issaquah Creek
 REACH: ISD Campus RS: 119

INPUT

Description:

Station Elevation Data num= 14									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	70	6	70	9	64	13	63	18	61
22	62	27	62	36	60	50	60	57	62
66	63	86	65	93	66	105	67		

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
0	.05	13	.035	66	.05

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	13	66		27	22	19		.1	.3

Blocked Obstructions num= 1		
Sta L	Sta R	Elev
0	27	68

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	71.30	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.80	wt. n-Val.	0.050	0.035
0.050				
W.S. Elev (ft)	70.51	Reach Len. (ft)	27.00	22.00
19.00				

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep				
Crit W.S. (ft)		Flow Area (sq ft)	19.59	406.38
213.28				
E.G. slope (ft/ft)	0.002619	Area (sq ft)	19.59	406.38
213.28				
Q Total (cfs)	4160.00	Flow (cfs)	36.02	3176.45
947.53				
Top width (ft)	105.00	Top width (ft)	13.00	53.00
39.00				
Vel Total (ft/s)	6.51	Avg. Vel. (ft/s)	1.84	7.82
4.44				
Max Chl Dpth (ft)	10.51	Hydr. Depth (ft)	1.51	7.67
5.47				
Conv. Total (cfs)	81286.6	Conv. (cfs)	703.8	62067.9
18514.9				
Length wtd. (ft)	21.14	wetted Per. (ft)	14.74	59.56
42.72				
Min Ch El (ft)	60.00	Shear (lb/sq ft)	0.22	1.12
0.82				
Alpha	1.21	Stream Power (lb/ft s)	0.40	8.72
3.63				
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.24	0.84
0.47				
C & E Loss (ft)	0.02	Cum SA (acres)	0.07	0.10
0.08				

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: Issaquah Creek
 REACH: ISD Campus RS: 97

INPUT

Description:

Station Elevation Data num= 15									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	70	5	70	8	67	14	64	15	63
18	61	21	63	40	62	47	61	49	62
55	63	70	64	87	66	98	66	105	67

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
0	.045	15	.035	55	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
15	55	36	24	21	.1	.3

Blocked Obstructions num= 1		
Sta L	Sta R	Elev
0	22	68

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	71.22	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.98	wt. n-Val.	0.045	0.035
0.045				
W.S. Elev (ft)	70.24	Reach Len. (ft)	36.00	24.00
21.00				

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep				
Crit w.s. (ft)		Flow Area (sq ft)	21.57	280.49
262.90				
E.G. slope (ft/ft)	0.003970	Area (sq ft)	21.57	280.49
262.90				
Q Total (cfs)	4160.00	Flow (cfs)	54.61	2523.70
1581.69				
Top width (ft)	105.00	Top width (ft)	15.00	40.00
50.00				
Vel Total (ft/s)	7.36	Avg. Vel. (ft/s)	2.53	9.00
6.02				
Max Chl Dpth (ft)	9.24	Hydr. Depth (ft)	1.44	7.01
5.26				
Conv. Total (cfs)	66026.3	Conv. (cfs)	866.8	40055.4
25104.1				
Length wtd. (ft)	24.06	wetted Per. (ft)	16.07	45.47
53.46				
Min Ch El (ft)	61.00	Shear (lb/sq ft)	0.33	1.53
1.22				
Alpha	1.16	Stream Power (lb/ft s)	0.84	13.76
7.33				
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	0.23	0.66
0.37				
C & E Loss (ft)	0.06	Cum SA (acres)	0.06	0.07
0.06				

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: Issaquah Creek
 REACH: ISD Campus RS: 73

INPUT

Description:

Station Elevation Data num= 14									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	67	28	65	35	62	37	60	41	62
42	62	47	60	54	59	64	61	68	62
81	64	86	65	93	66	110	67		

Manning's n Values num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
0	.04	35	.035	68	.045

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	35	68		78	73	62		.1	.3

Blocked Obstructions num= 1		
Sta L	Sta R	Elev
0	42	66

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	71.08	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.79	wt. n-Val.	0.040	0.035
0.045				
W.S. Elev (ft)	70.30	Reach Len. (ft)	78.00	73.00
62.00				

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep				
Crit w.s. (ft)		Flow Area (sq ft)	143.37	290.27
221.94				
E.G. slope (ft/ft)	0.002583	Area (sq ft)	143.37	290.27
221.94				
Q Total (cfs)	4160.00	Flow (cfs)	652.19	2438.86
1068.95				
Top width (ft)	110.00	Top width (ft)	35.00	33.00
42.00				
Vel Total (ft/s)	6.35	Avg. Vel. (ft/s)	4.55	8.40
4.82				
Max Chl Dpth (ft)	11.30	Hydr. Depth (ft)	4.10	8.80
5.28				
Conv. Total (cfs)	81851.2	Conv. (cfs)	12832.4	47986.5
21032.4				
Length wtd. (ft)	71.11	wetted Per. (ft)	38.33	37.78
45.65				
Min Ch El (ft)	59.00	Shear (lb/sq ft)	0.60	1.24
0.78				
Alpha	1.26	Stream Power (lb/ft s)	2.74	10.41
3.78				
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	0.16	0.50
0.25				
C & E Loss (ft)	0.07	Cum SA (acres)	0.04	0.05
0.04				

Warning: The cross-section end points had to be extended vertically for the computed water surface.

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Issaquah Creek

REACH: ISD Campus RS: 0

INPUT

Description: Downstream Cross Section

Station Elevation Data		num=	9						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	68	5	68	11	60	13	59	15	58
27	58	32	59	40	60	56	62		

Manning's n Values		num=	3						
Sta	n Val	Sta	n Val	Sta	n Val				
0	.035	11	.035	40	.045				

Bank Sta: Left	Right	Coeff	Contr.	Expan.
11	40	.1	.3	

CROSS SECTION OUTPUT Profile #100 Year

E.G. Elev (ft)	70.83	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.44	wt. n-Val.	0.035	0.035
0.045				
W.S. Elev (ft)	69.39	Reach Len. (ft)		
Crit w.s. (ft)	66.15	Flow Area (sq ft)	39.29	311.81

Page 6

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep				
134.24				
E.G. Slope (ft/ft)	0.002656	Area (sq ft)	39.29	311.81
134.24				
Q Total (cfs)	4160.00	Flow (cfs)	153.99	3276.25
729.76				
Top width (ft)	56.00	Top width (ft)	11.00	29.00
16.00				
Vel Total (ft/s)	8.57	Avg. Vel. (ft/s)	3.92	10.51
5.44				
Max Chl Dpth (ft)	11.39	Hydr. Depth (ft)	3.57	10.75
8.39				
Conv. Total (cfs)	80712.4	Conv. (cfs)	2987.8	63565.7
14158.9				
Length wtd. (ft)		Wetted Per. (ft)	16.39	29.63
23.51				
Min Ch El (ft)	58.00	Shear (lb/sq ft)	0.40	1.75
0.95				
Alpha	1.26	Stream Power (lb/ft s)	1.56	18.34
5.15				
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

SUMMARY OF MANNING'S N VALUES

River: Issaquah Creek

Reach	River Sta.	n1	n2	n3
ISD Campus	141	.05	.035	.05
ISD Campus	119	.05	.035	.05
ISD Campus	97	.045	.035	.045
ISD Campus	73	.04	.035	.045
ISD Campus	0	.035	.035	.045

SUMMARY OF REACH LENGTHS

River: Issaquah Creek

Reach	River Sta.	Left	Channel	Right
ISD Campus	141	34	22	6
ISD Campus	119	27	22	19
ISD Campus	97	36	24	21
ISD Campus	73	78	73	62
ISD Campus	0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

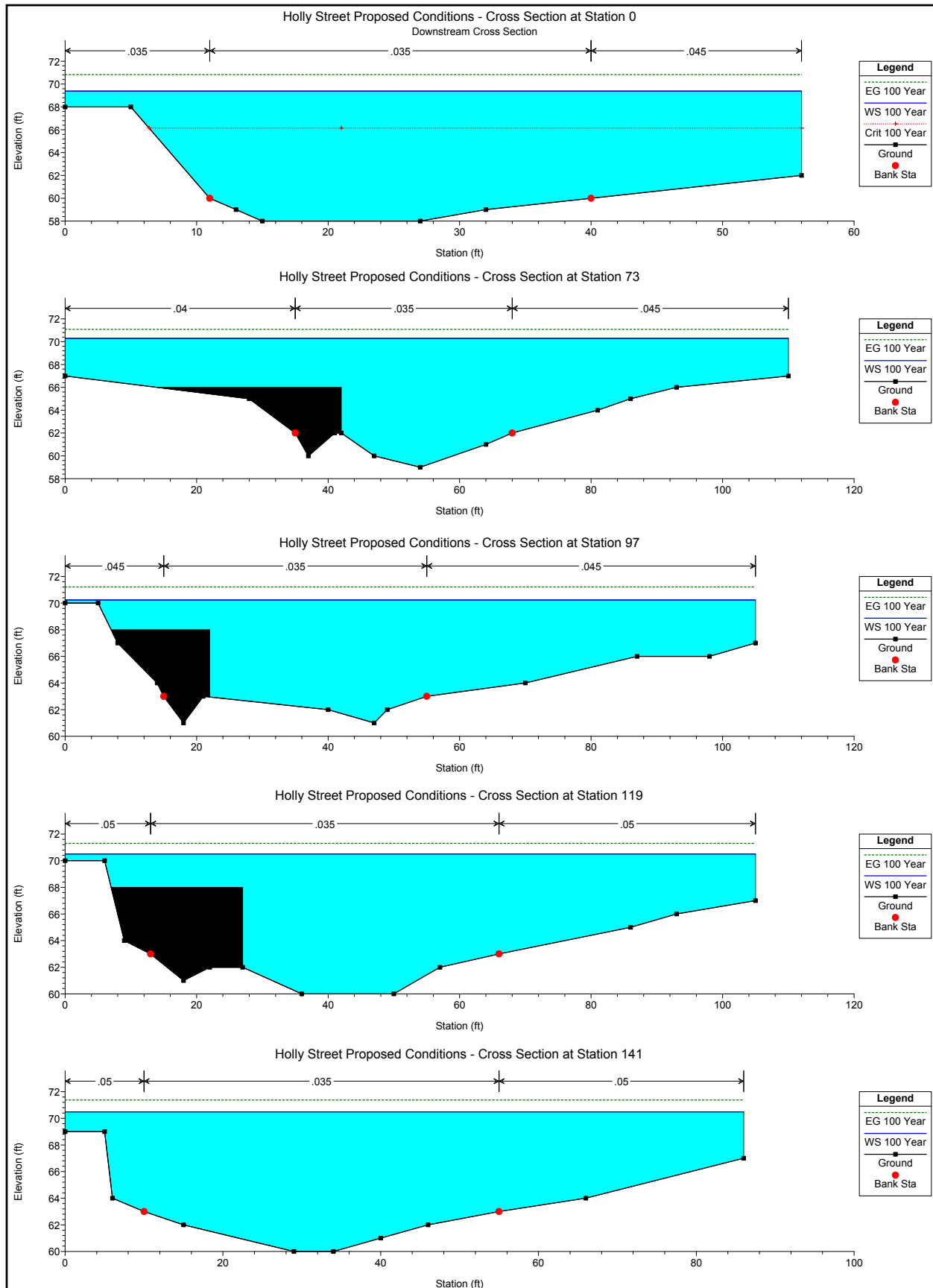
River: Issaquah Creek

Reach	River Sta.	Contr.	Expan.
		Page 7	

Appendix C - HEC-RAS Analysis (Existing Conditions)

HollyStreet2021.rep				
ISD Campus	141	.1	.3	
ISD Campus	119	.1	.3	
ISD Campus	97	.1	.3	
ISD Campus	73	.1	.3	
ISD Campus	0	.1	.3	

Appendix C - HEC-RAS Analysis (Existing Conditions)



APPENDIX C

ISD Holly Street Campus Tree Risk Assessment (Washington Forestry
Consultants, Inc.) September 28,2020

WASHINGTON FORESTRY CONSULTANTS, INC.

FORESTRY AND VEGETATION MANAGEMENT SPECIALISTS



W F C I

360/943-1723
FAX 360/943-4128

1919 Yelm Hwy SE, Suite C
Olympia, WA 98501

September 28, 2020

Janelle Walker
Issaquah School District
5150 220th Ave. SE
Issaquah, WA 98029

RE: ISD Holly Street Campus Creek Bank Repair Tree Risk Assessment

Dear Ms. Walker:

We have evaluated eight trees on the ISD Holly Street Campus in Issaquah, WA. The purpose of the evaluation was to perform a risk assessment, identify any hazard trees and make recommendations for cultural care. A level 2 assessment was conducted on September 23, 2020.

Findings and Recommendations

Six Douglas-fir (*Pseudotsuga menziesii*), one black cottonwood (*Populus trichocarpa*) and one western redcedar (*Thuja plicata*) trees were found growing along the bank of Issaquah Creek. The trees are downstream of a proposed creek bank repair project. The creek is eroding away the creek bank to the east of the trees potentially making them unstable. A number at the base of the tree, in blue paint, was used to identify the subject trees.

Six of tree are in 'Fair' or better condition and two trees are in 'Poor' or worse condition. The edge of the creek bank varies between 5 and 12 feet from the subject trees. The creek edge is within the Critical Root Zones (CRZ) of the all the trees. The CRZ is the area of soil extending from the tree trunk where roots required for future tree health and survival are located. This area can also be defined as a circle with a minimum radius of 1' for every 1" in trunk diameter at 4.5" above ground. The bank will continue to erode further into the CRZ creating higher risk of tree failure. There are already additional areas of the bank that are beginning to sloughing off into the creek.

The trees are all currently at a 'Moderate' risk of failing and impacting targets. The trees should be removed to eliminate the risk of whole tree failure. The trees' stump and roots should remain in place to minimize soil disturbance to the bank and help prevent future bank erosion.

Table 1: Evaluated Trees on the ISD Holly Street Campus Site.

Tree #	Species	DBH (in.)	Condition	Risk Rating	Target	Recommended Work
1	Cottonwood	14	Very Poor- decay in stem	Moderate – Whole Tree	School building and parking area	Remove Tree
2	Douglas-fir	29	Fair- Sound, healthy	Moderate – Whole Tree	School building and parking area	Remove Tree
3	Douglas-fir	20	Good- Sound, healthy	Moderate – Whole Tree	School building and parking area	Remove Tree
4	Douglas-fir	18	Good- Sound, healthy	Moderate – Whole Tree	School building and parking area	Remove Tree
5	Douglas-fir	23	Fair- Sound, healthy	Moderate – Whole Tree	School building and parking area	Remove Tree
6	Douglas-fir	14	Poor-suppressed	Moderate – Whole Tree	School building	Remove Tree
7	Douglas-fir	26	Fair- Sound, healthy	Moderate – Whole Tree	School building	Remove Tree
8	Western Redcedar	19,24	Fair- Sound, healthy	Moderate – Whole Tree	School building	Remove Tree

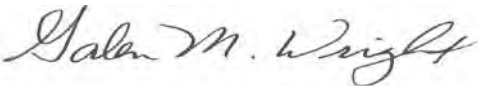
Summary

Six Douglas-fir, one black cottonwood and one western redcedar trees were evaluated on the ISD Holly Street Campus site. Six of tree are in 'Fair' or better condition and two trees are in 'Poor' or worse condition. The bank of the creek has eroded and encroached into the Critical Root Zone of all the trees, creating the potential for whole tree failure. The trees are at a 'Moderate' risk of failing and impacting targets. The trees should be removed to eliminate the risk of failure, leaving the stump and roots to help prevent future soil erosion.

Please give us a call if you have any questions.

Respectfully Submitted,

Washington Forestry Consultants, Inc.

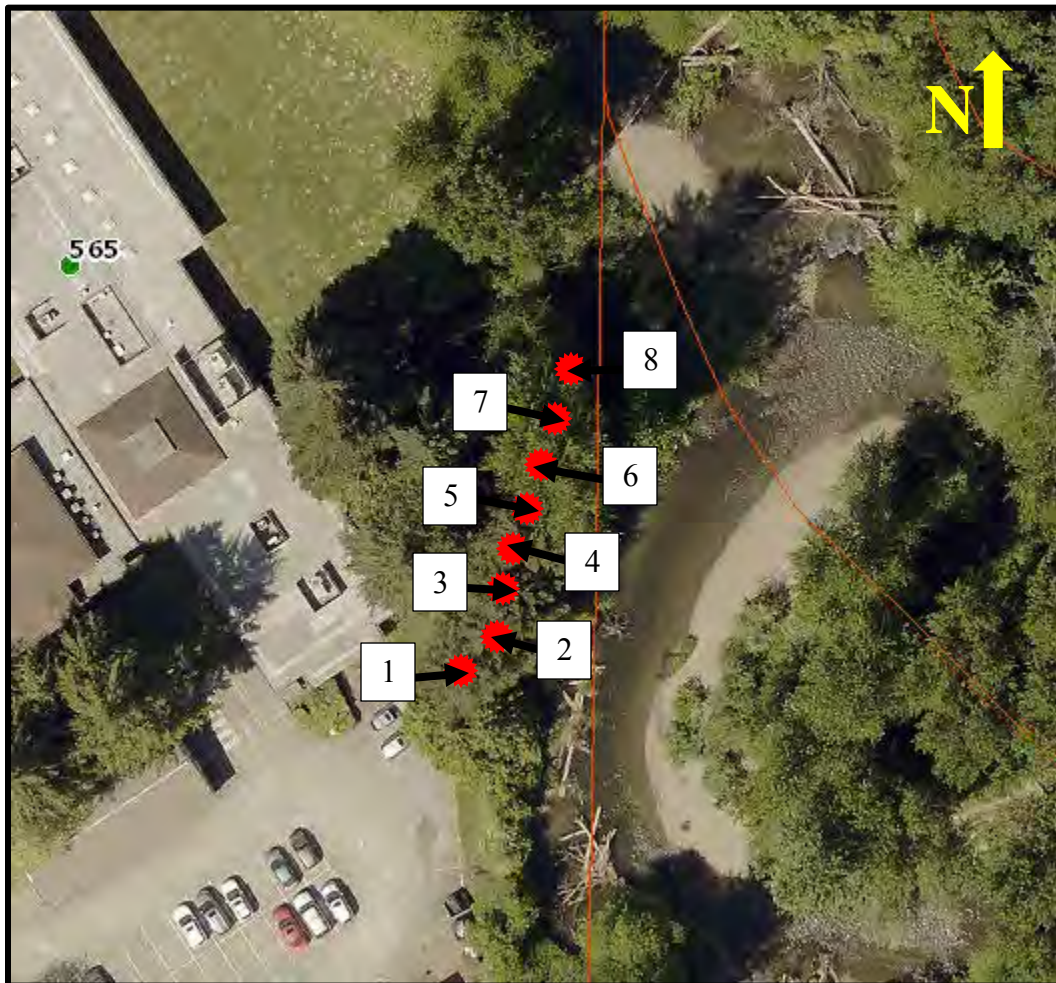


Galen M. Wright, ACF, ASCA
ISA Bd. Certified Master Arborist PN-129BU
Certified Forester No. 44
ISA Tree Risk Assessor Qualified
ASCA Tree and Plant Appraisal Qualified



Joshua Sharpes
Certified Arborist/
Municipal Specialist, PN-5953AM

Attachment 1. Location of Evaluated Trees at ISD Holly Street Campus
(King County iMap 2019)



 Location of Removal Tree

Attachment 2. Photo Log (WFCI 9/23/20)



Photo 1. View of evaluated trees.



Photo 2. View of edge of bank and Tree #2.

Attachment 3. Tree Risk Assessment – A Description of the Process

The purpose of this attachment is to summarize the methodology of modern tree risk assessment for users of this type of information. This methodology has been put into place by the International Society of Arboriculture and has been in use in its present form since 2013. It updates the initial changes put into place in 2011.

Tree risk assessment is the systematic and qualitative process to identify, analyze, and evaluate tree risk. Tree risk evaluation is the process of comparing the assessed risk against given risk criteria to determine the significance of the risk. This methodology is based on the ANSI A300 standard¹ for tree risk assessment. This standard is supported by a best management practices guide².

Those qualified to do tree risk assessment have the qualification from the International Society of Arboriculture called ‘**Tree Risk Assessor Qualified.**’ The methodology for tree risk assessment is more recently detailed in the authoritative tree risk assessment manual³, which provides the state of the art for tree risk assessment.

Risk is the evaluation and categorizing of both the likelihood (probability) of occurrence of a tree or tree part failure, and the severity of consequences (value of and damage to the target that is impacted). The magnitude of risk can be categorized and compared to the client’s tolerances to determine if the risk is acceptable.

Tree risk management is the application of policies, procedures and practices used to identify, evaluate, mitigate, monitor, and communicate tree risk. It is up to the tree owner to determine what level of risk they are able to tolerate, and to conduct any mitigation required when that risk is unacceptable.

There are 3 levels of tree risk assessment:

Level 1 – assessment is limited to a visual assessment of the tree(s) near specified targets, such as along roadways or utility rights-of-ways to identify specified conditions or obvious defects. Assessment shall be from a specified perspective such as foot, vehicle, or aerial patrol.

Level 2 – assessment shall include a 360 degree, ground based visual inspection of the tree crown, trunk, trunk flare, above-ground roots, and site conditions around the tree in relation to

¹ ANSI A300 (Part 9 – 2011) – *American National Standard for Tree Care Operations – Tree, Shrub, and Other Woody Plant Management – Standard Practices (Tree Risk Assessment a. Tree Structure Assessment)*. American National Standards Institute, Inc. Washington D.C. 14 pgs.

² Smiley, E. Thomas, Nelda Matheny, and Sharon Lilly. 2011. *Best Management Practices – Tree Risk Assessment*. International Society of Arboriculture. Champaign, IL.

³ Dunster, Dr. Julian et al. 2013. *Tree Risk Assessment Manual*. International Society of Arboriculture. Champaign, IL.

targets. It may include sounding the stem to look for internal decay and/or the use of hand tools, or binoculars to view the crown better. Surrounding site conditions are also evaluated.

Level 3 – all of the level 2 techniques, plus advanced methodologies such as coring or drilling the tree stem or roots to look for decay, a climbing assessment, probing, pull testing, or radiation, sonic, or subsurface root assessments.

In tree risk assessment, **targets** are people who could be injured, property that may be damaged, or activities that could be disrupted by a tree failure. A tree must have a target for there to be a risk rating higher than ‘Low’. The target has a value and people are the highest value target, followed by structures, cars and other high value objects. Fences would be a low value target. As part of a target assessment, the assessor considers if the target can be moved out of reach of the tree or tree part that might fail, or if people could be excluded from the target area of the tree.

As part of the risk analysis, the assessor must conduct a site analysis. This may include looking for signs of recent tree removal that may expose a previously sheltered subject tree to winds, construction activity that severed roots of the tree, or other site or soils conditions/changes that affected drainage or tree health.

Defects often predispose a tree or part of a tree to failure. A key part of tree risk assessment is to categorize the likelihood of failure of the tree or a defective part. The tree or defect is examined, and the likelihood of failure is categorized in a matrix (below) as: **Improbable, Possible, Probable, or Imminent**. A tree with a lifting root plate would likely be categorized as ‘Imminent’ to fail. A tree with a broken and hanging branch that is still attached would likely be categorized as ‘Improbable’ or ‘Possible.’ Cracks in a trunk or branch would likely be categorized as ‘Probable’ or ‘Imminent’ to fail.

This rating of ‘**Likelihood of Failure**’ is then brought forward into the Likelihood of Failure and Impact matrix to assign a level of risk of the tree. The level of risk is then categorized as **Low, Moderate, High, or Extreme**.

The following 2 tables are used by Tree Risk Assessor Qualified professionals to rate the risk of the tree. Note: this system does not use a numerical rating system as old systems used.

Matrix 1. Likelihood matrix.

Likelihood of Failure	Likelihood of Impacting Target			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2. Risk rating matrix.

Likelihood of Failure & Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Attachment 4. Assumptions and Limiting Conditions.

- 1) Any legal description provided to the Washington Forestry Consultants, Inc. is assumed to be correct. Any titles and ownership's to any property are assumed to be good and marketable. No responsibility is assumed for matters legal in character. Any and all property is appraised or evaluated as though free and clear, under responsible ownership and competent management.
- 2) It is assumed that any property is not in violation of any applicable codes, ordinances, statutes, or other governmental regulations, unless otherwise stated.
- 3) Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, Washington Forestry Consultants, Inc. can neither guarantee nor be responsible for the accuracy of information.
- 4) Washington Forestry Consultants, Inc. shall not be required to give testimony or to attend court by reason of this report unless subsequent contractual arrangements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.
- 5) Loss or alteration of any part of this report invalidated the entire report.
- 6) Possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the prior expressed written or verbal consent of Washington Forestry Consultants, Inc.
- 7) Neither all or any part of the contents of this report, nor copy thereof, shall be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales or other media, without the prior expressed written or verbal consent of Washington Forestry Consultants, Inc. -- particularly as to value conclusions, identity of Washington Forestry Consultants, Inc., or any reference to any professional society or to any initialed designation conferred upon Washington Forestry Consultants, Inc. as stated in its qualifications.
- 8) This report and any values expressed herein represent the opinion of Washington Forestry Consultants, Inc., and the fee is in no way contingent upon the reporting of a specified value, a stipulated result, the occurrence neither of a subsequent event, nor upon any finding in to reported.
- 9) Sketches, diagrams, graphs, and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys.
- 10) Unless expressed otherwise: 1) information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection; and 2) the inspection is limited to visual examination of accessible items without dissection, excavation, probing, or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the tree or other plant or property in question may not arise in the future.

Note: Even healthy trees can fail under normal or storm conditions. The only way to eliminate all risk is to remove all trees within reach of all targets. Annual monitoring by an ISA Certified Arborist or Certified Forester will reduce the potential of tree failures. It is impossible to predict with certainty that a tree will stand or fail, or the timing of the failure. It is considered an 'Act of God' when a tree fails, unless it is directly felled or pushed over by man's actions.

APPENDIX D

ESA-Listed Species Maps

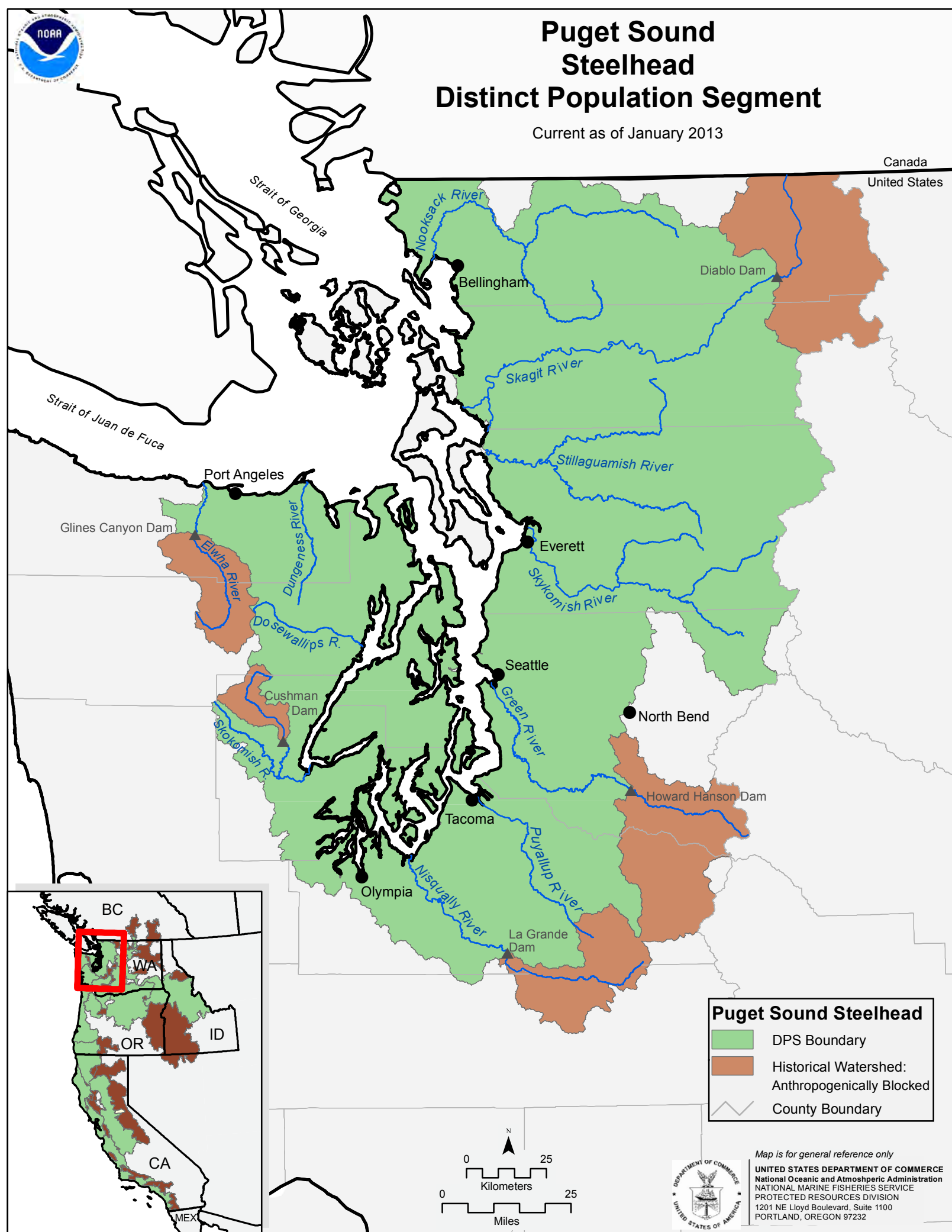


Puget Sound Steelhead Distinct Population Segment

Current as of January 2013

Canada

United States

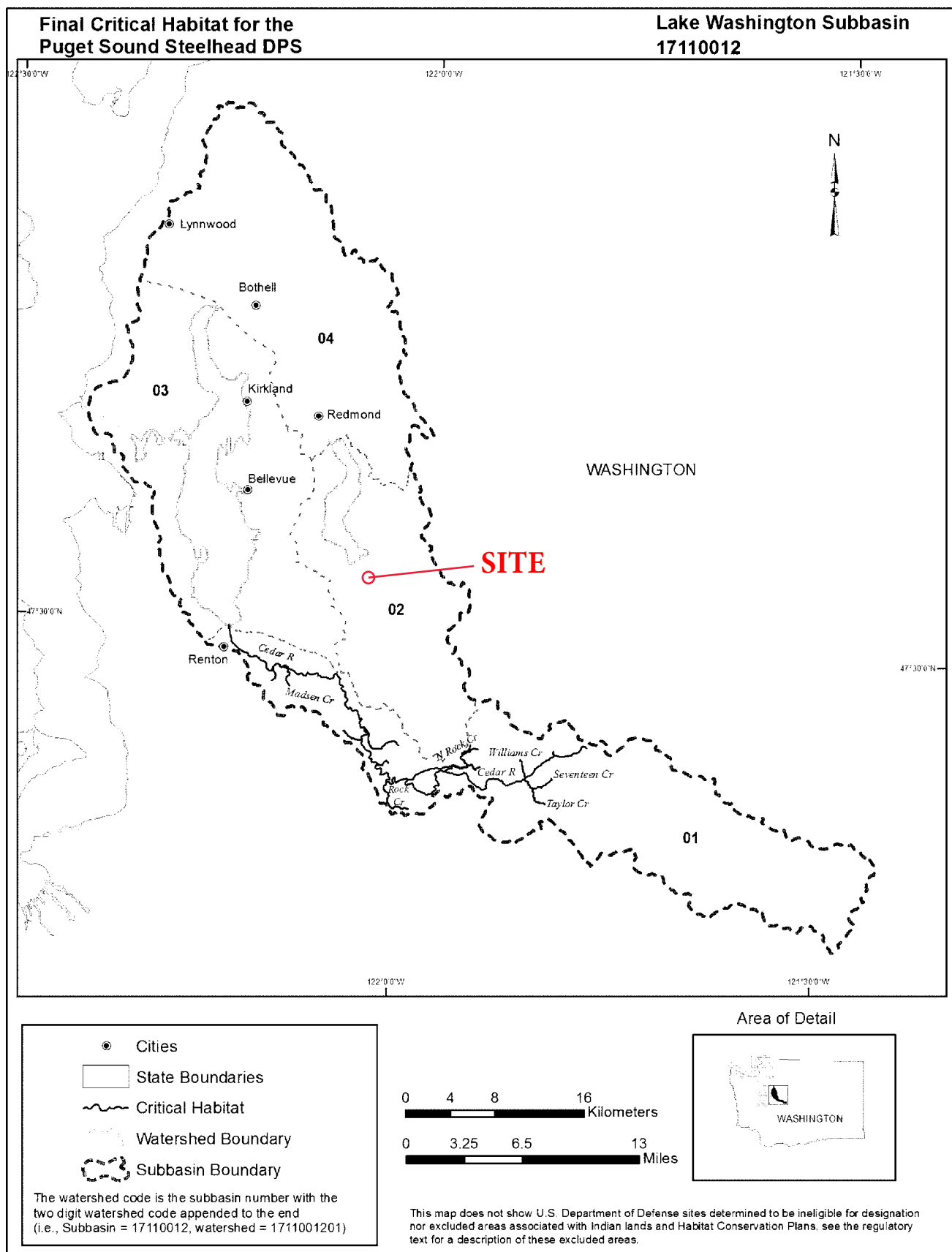


Puget Sound Steelhead

- DPS Boundary
- Historical Watershed:
- Anthropogenically Blocked
- County Boundary

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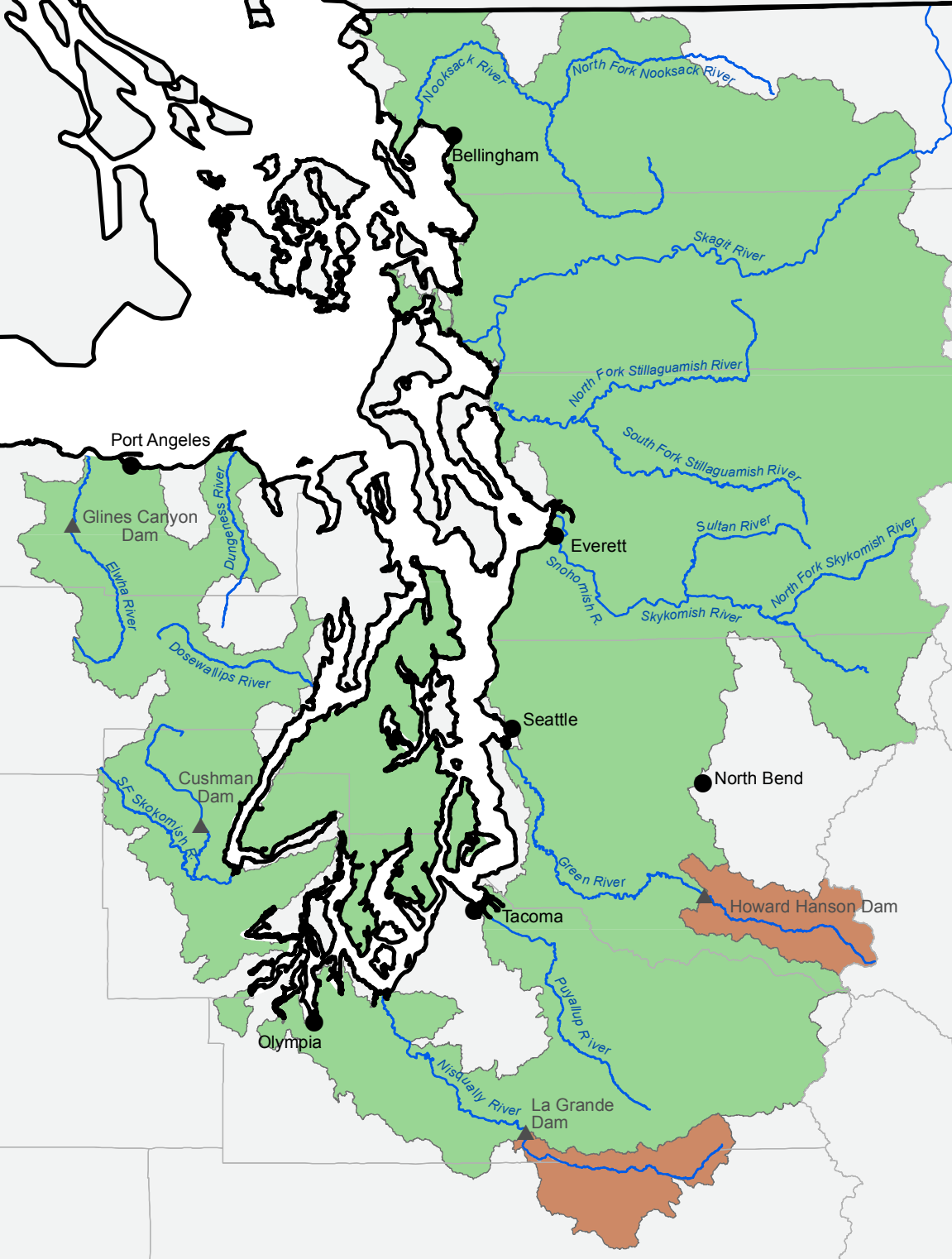
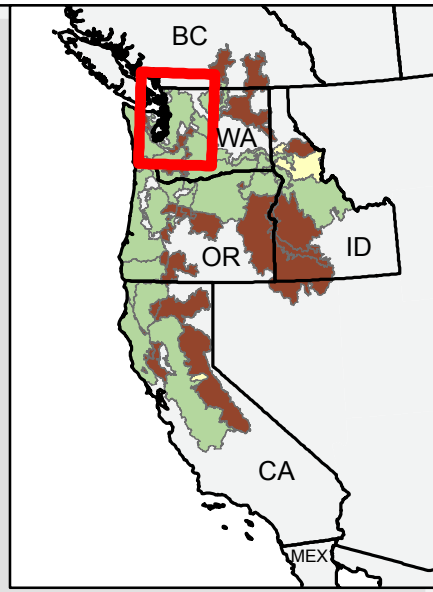






Puget Sound Chinook Salmon Evolutionarily Significant Unit

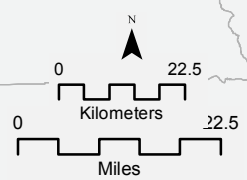
Current as of January 2015



County Boundary

Class

- ESU Boundary
- Historical Watershed: Anthropogenically Blocked

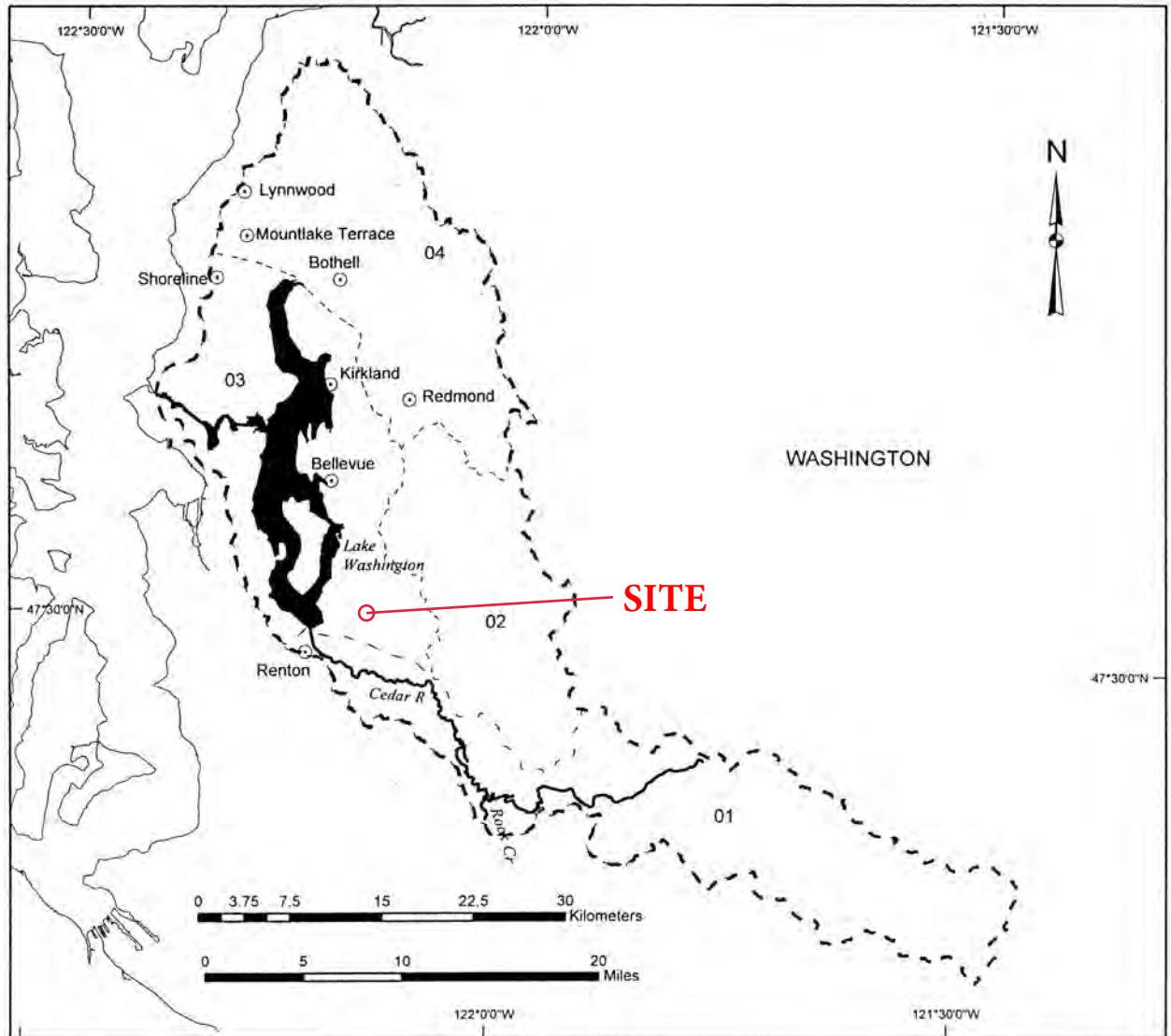


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Final Critical Habitat for the Puget Sound Chinook Salmon ESU

LAKE WASHINGTON SUBBASIN
17110012



Legend

-  **Cities / Towns**
-  **Shoreline**
-  **Critical Habitat**
-  **Water Bodies**
-  **Subbasin Boundary**
-  **Watershed Boundaries**

01 - 04 = Watershed code - last 2 digits of 17110012xx

Area of Detail

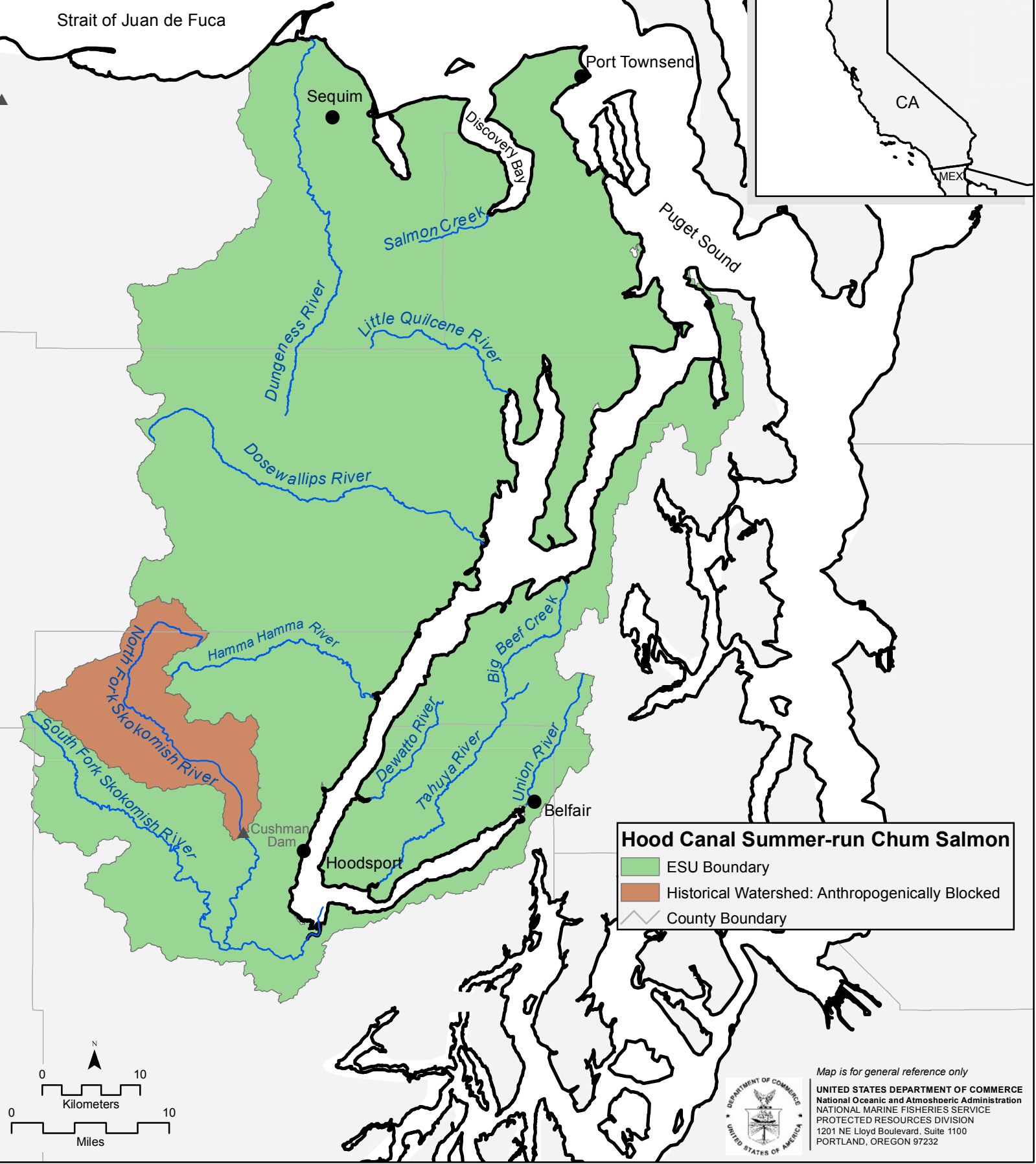
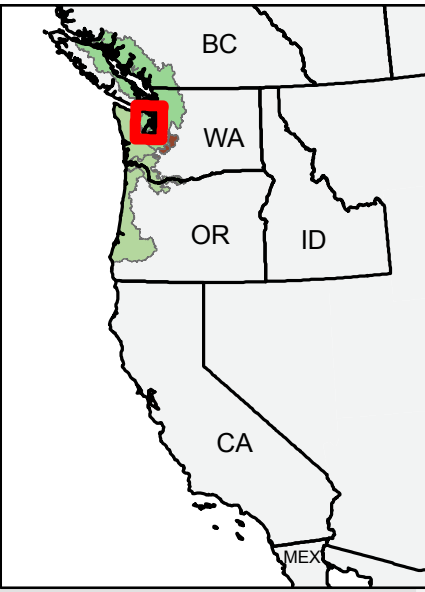




Hood Canal Summer-run Chum Salmon

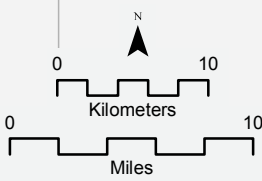
Evolutionarily Significant Unit

Current as of January 2013



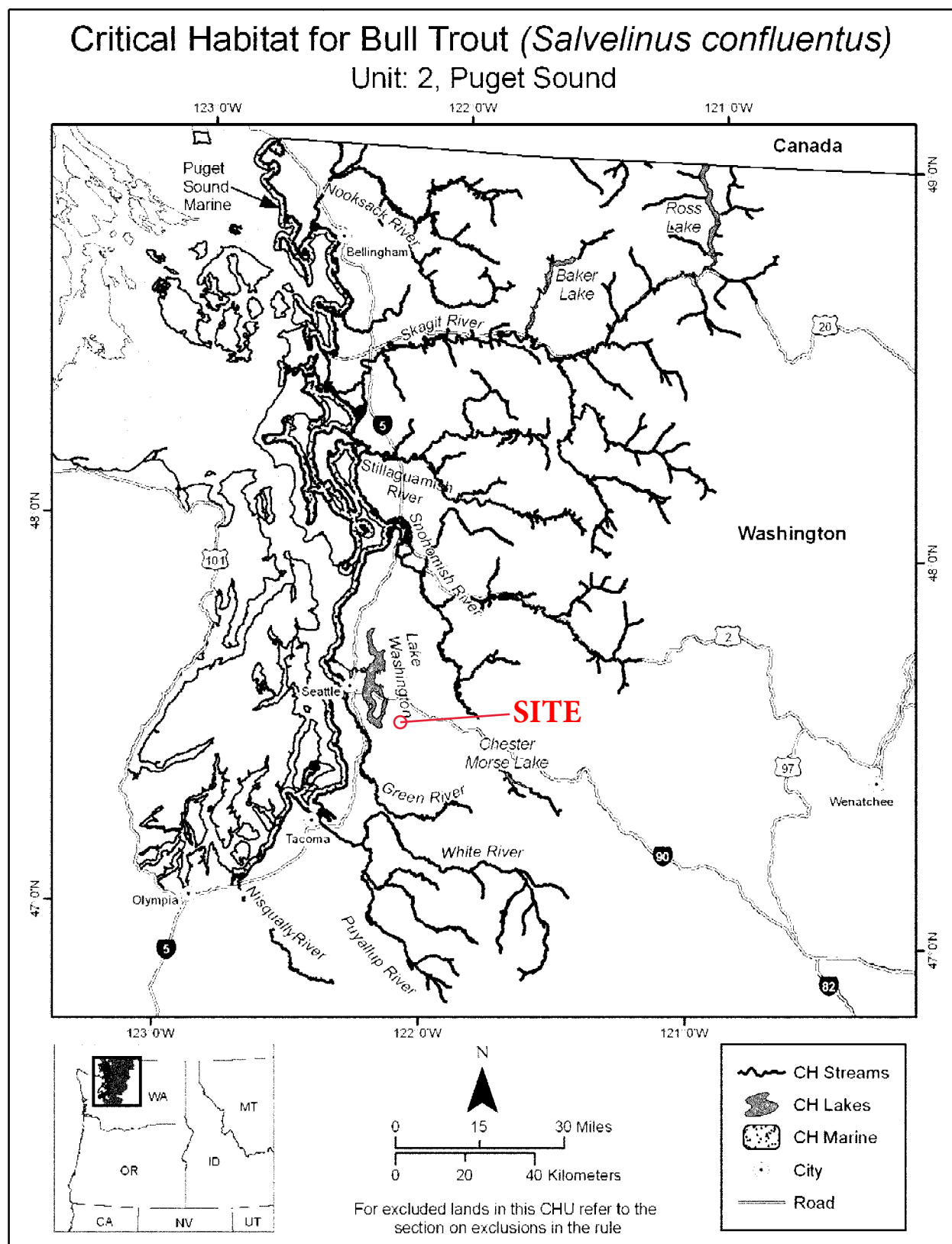
Hood Canal Summer-run Chum Salmon

- ESU Boundary
- Historical Watershed: Anthropogenically Blocked
- County Boundary



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BILLING CODE 4310-55-C

(10) Unit 3: Lower Columbia River Basins

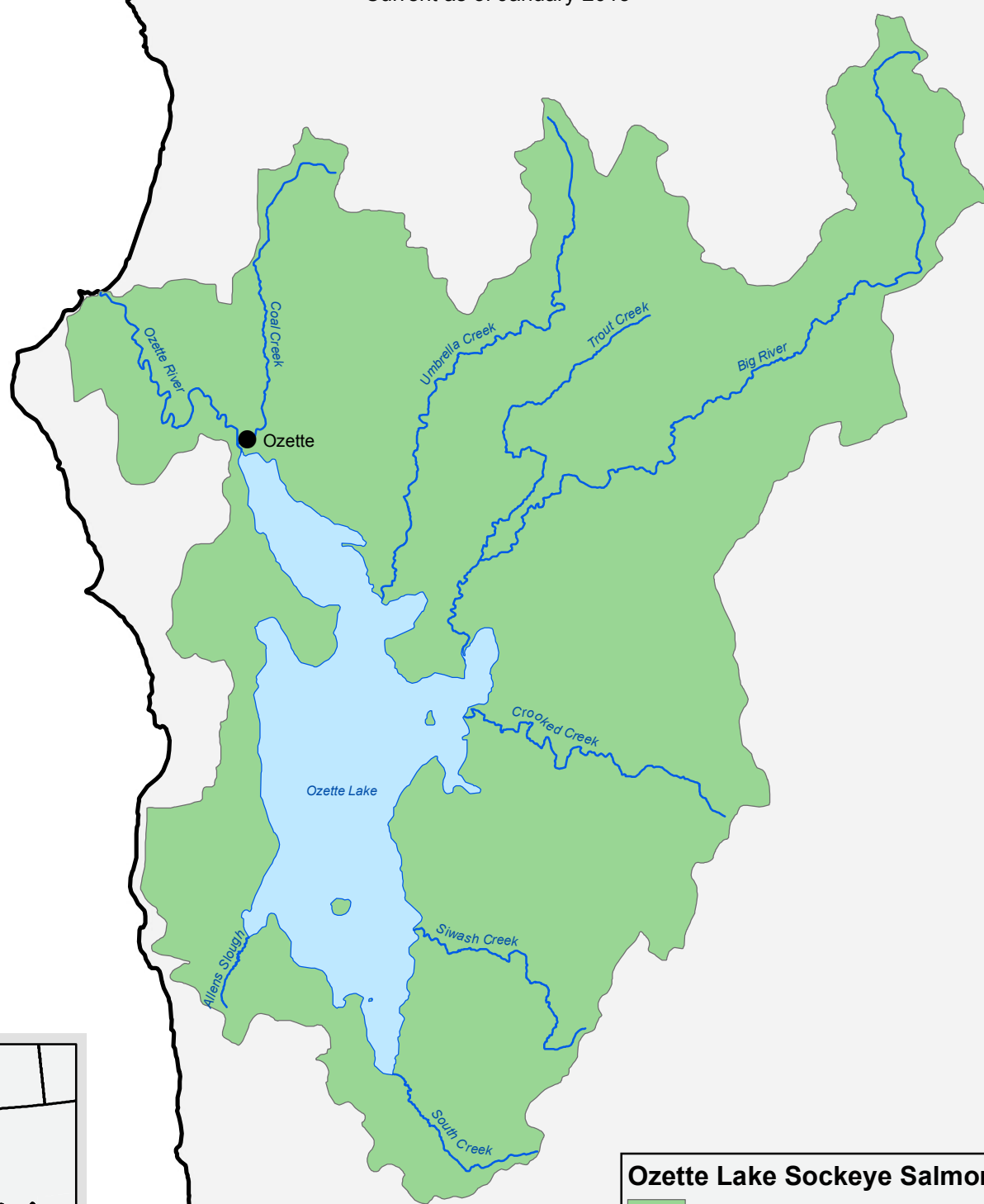
(i) This unit consists of 119.3 km (74.2 mi) of streams. The unit is located in southwestern Washington.

(ii) Individual waterbodies in the unit are bounded by the following coordinates:



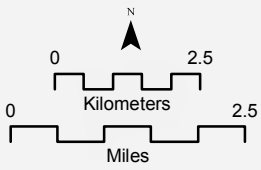
Ozette Lake Sockeye Salmon Evolutionarily Significant Unit

Current as of January 2013

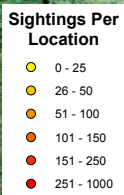
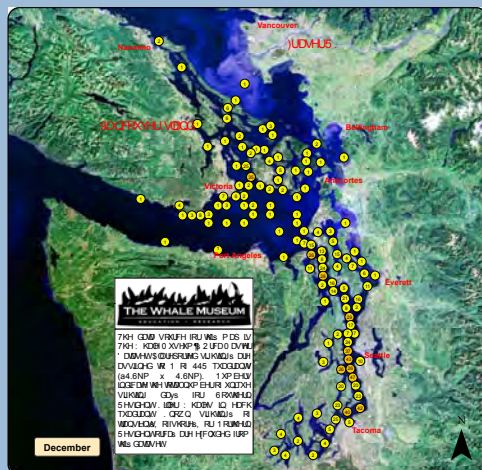
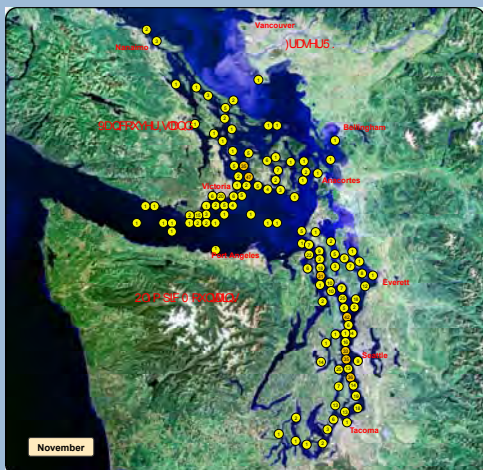
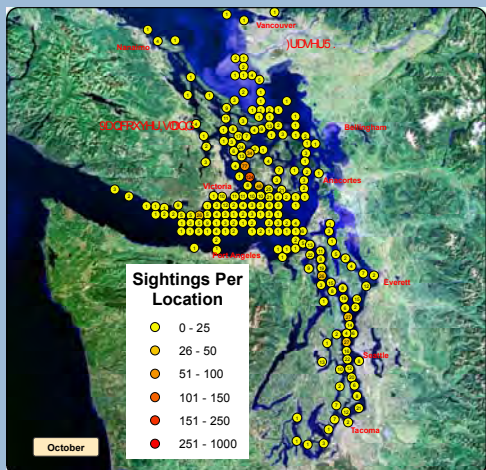
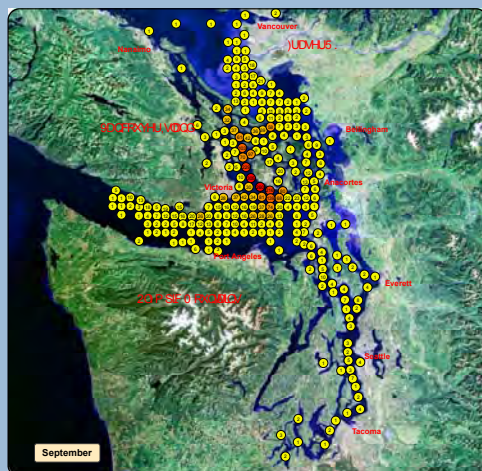
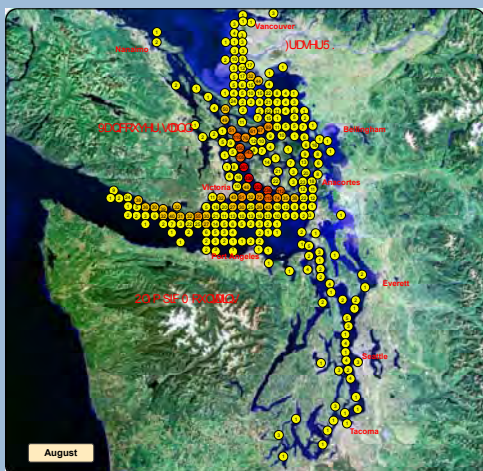
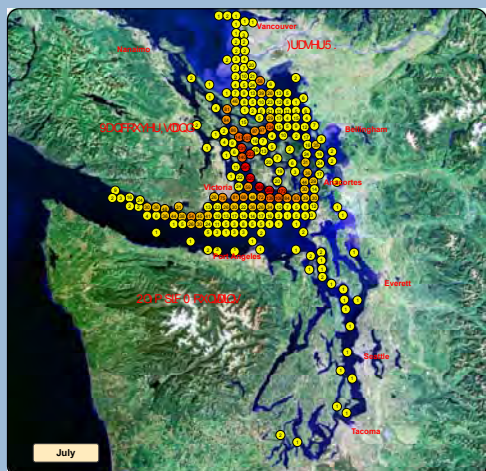
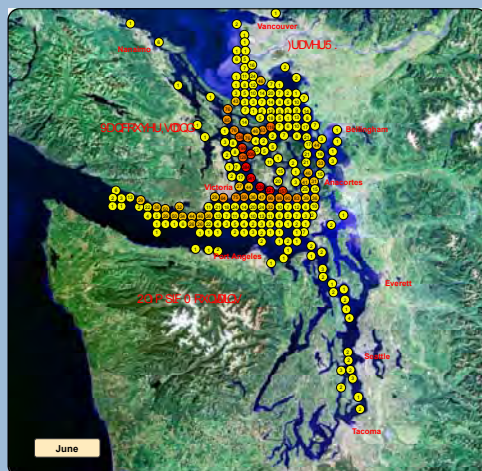
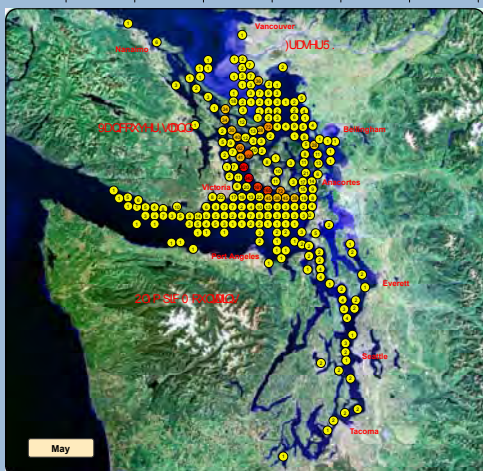
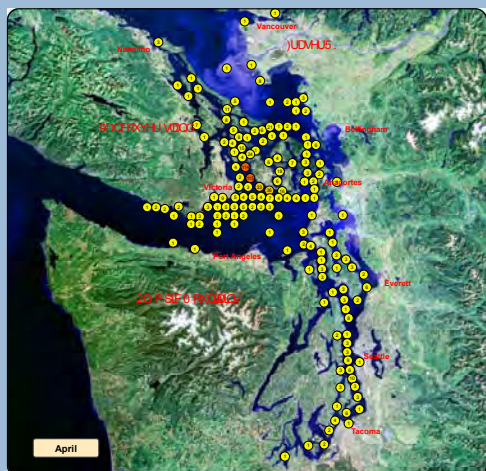
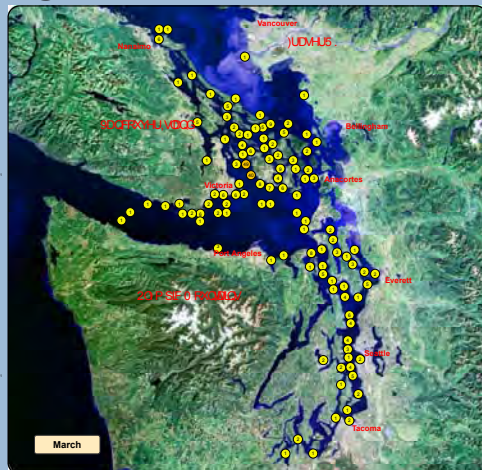
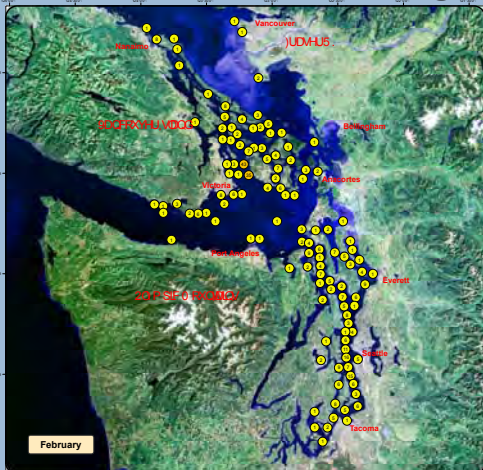
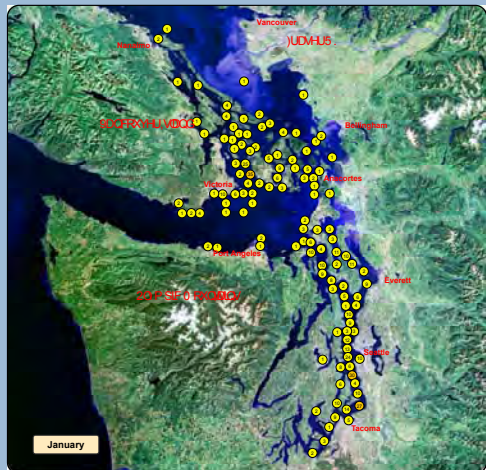


Ozette Lake Sockeye Salmon

- ESU Boundary
- County Boundary



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APPENDIX E

Species Life Histories & Status of Stock

STEELHEAD (*ONCORHYNCHUS MYKISS*) - THREATENED

Life History

The life history of (*Oncorhynchus mykiss*) is one of the most complex of any of the salmonid species (Myers 2015). The species exhibits both anadromous (steelhead) and resident (rainbow trout) forms. The anadromous form resides in the marine environment for two to three years prior to returning to their natal stream to spawn as 4- or 5-year-old fish. Unlike Pacific salmon, steelhead trout are iteroparous or capable of spawning more than once before they die. However, it is rare for steelhead to spawn more than twice before dying, and those that do are usually females. Biologically, steelhead can be divided into two reproductive ecotypes, based on their state of sexual maturity at the time of river entry. These two ecotypes are termed “stream-maturing” and “ocean-maturing”. Stream-maturing steelhead enter fresh water in a sexually immature condition and require from several months to a year to mature and spawn. These fish are often referred to as “summer run” steelhead. Ocean maturing steelhead enter fresh water with well-developed gonads and spawn shortly after river entry. These fish are commonly referred to as “winter-run” steelhead.

Depending on water temperature, fertilized steelhead eggs may incubate in redds for 1.5 to 4 months before hatching as “alevins”. Following yolk sac absorption, young juveniles or “fry” emerge from the gravel and begin active feeding. Juveniles rear in fresh water for 1 to 4 years, then migrate to the ocean as smolts.

Status of the Stock

Species baseline information was obtained using WDFW’s Salmon Conservation Reporting Engine (SCoRE; WDFW 2021b). Escapement data for natural spawners within Issaquah Creek has not been recorded by this resource. However, escapement data for North Lake Washington and Lake Sammamish has shown a steady decline from the 1980s to 1999, with total of 4 natural spawners last recorded in 1999. Due to the decline of the population caused by man-made changes to Lake Washington and Black River, North Lake Washington and Sammamish tributaries have not been monitored since 2000 (WDFW 2021b). In addition, due to the small numbers of steelhead seen at the Chittenden Locks and estimated in the Cedar River, it is unlikely that there are currently many steelhead in these tributaries (WDFW 2021b). Therefore, it is unclear to what degree steelhead utilize tributaries in the Lake Washington Basin. Evermann and Meek (1898) suggested that small numbers of steelhead migrated up the Sammamish River into Lake Sammamish, although they did not observe any in their sampling. Currently, WDFW (2021) lists a number of tributaries Lake Washington and Lake Sammamish, including Issaquah Creek, as supporting steelhead even though Chittenden Locks see small numbers. Based on the status of the stock described above, it is unlikely that Steelhead will be present within the Action Area during construction.

CHINOOK (*ONCORHYNCHUS TSHAWYTSCHA*) - THREATENED

Life History

Chinook salmon (*Oncorhynchus tshawytscha*) is the largest of the Pacific salmon (WDFW 2021b). Also known as “king” salmon, adult Chinook salmon migrate from a marine environment into fresh water streams and rivers of their birth where they spawn and die. Among Chinook salmon, two distinct races have evolved. 1) A “stream-type” Chinook is found most commonly in headwater streams. Stream-type Chinook salmon have a longer freshwater residency and perform extensive offshore migrations before returning to their natal streams in the spring or summer months. 2) A “ocean-type” Chinook, which is commonly found in coastal streams in North America. Ocean-type

Chinook typically migrate to sea within the first three months of emergence, but they may spend up to a year in freshwater prior to emigration. They also spend their ocean life in coastal waters. Ocean-type Chinook salmon return to their natal streams or rivers as spring, winter, fall, summer, and late fall runs, but summer and fall runs predominate (Healey 1991). The difference between these life history types is physical, with both genetic and morphological foundations. Puget Sound Chinook salmon primarily exhibit the ocean-type life history, and typically spend up to a few weeks in freshwater.

Adult female Chinook will prepare a spawning bed, called a redd, in a stream area with suitable gravel composition, water depth and velocity. Redds will vary widely in size and in location within the stream or river. After laying eggs in a redd, adult fish will guard the redd for 4 to 25 days before dying. Chinook salmon eggs will hatch, depending upon water temperatures, between 90 to 150 days after deposition. Stream flow, gravel quality, and silt load all significantly influence the survival of developing Chinook salmon eggs. Juvenile Chinook may spend from 3 months to 2 years in freshwater before migrating to estuarine areas as smolts, and then into the ocean to feed and mature. Juvenile Chinook salmon feed primarily on aquatic insect larvae and terrestrial insects, typically in the nearshore areas.

Status of the Stock

Species baseline information was obtained using WDFW's Salmon Conservation Reporting Engine (SCoRE; WDFW 2021b). Sammamish Chinook, formerly North Lake Washington Tribes Chinook primarily spawn in Issaquah Creek, Bear Creek, and Cottage Lake Creek. Escapement data for Sammamish Chinook include both natural and hatchery spawners. Chinook counts have been variable between the years 1983 and 2019, with natural spawners maintaining low counts of less than 500 and hatchery spawners on a general decline since 2017. Counts for spawners in 2019 include 109 for natural and 256 for hatchery, substantial down from 2017 counts; 203 for natural and 1,321 for hatchery.

Specific to Issaquah Creek Hatchery, 1,739 hatchery and 47 wild adults were trapped and 30 hatchery and 2 wild adults were released during 2018 - 2019 season. Total trapped represents the total number of fish trapped at the hatchery rack. The total trapped may not represent the total run to any given river due to the presence of either wild, hatchery, or mixed stocks that may spawn below the hatchery rack; may die, or be harvested below the hatchery via sport, commercial, or tribal fisheries (WDFW 2021c). Adult Chinook begin migrating through the Chittenden Locks into the Cedar/Sammamish watershed in June, peaking in August, and continuing until early October (Berg, Hammer, and Foley 2006). Based on the information described above, it is possible that Chinook will be present in Issaquah Creek if construction occurs during this migration window.

BULL TROUT (*SALVELINUS CONFLUENTUS*) - THREATENED

General Life History

The Coastal/Puget Sound bull trout population segment encompasses all Pacific Coast drainages within Washington, including Puget Sound. This population segment is discrete because the Pacific Ocean and the crest of the Cascade Mountain Range geographically segregate it from subpopulations. The population segment is significant to the species as a whole because it is thought to contain the only anadromous forms of bull trout in the conterminous U.S., thus, occurring in a

unique ecological setting. No bull trout exist in coastal drainages south of the Columbia River.

Bull trout are generally non-anadromous and live in a variety of habitats including small streams, large rivers, and lakes or reservoirs. However, Coastal/Puget Sound bull trout are anadromous, migrating and maturing in Puget Sound or the Pacific Ocean. They may spend the first 2 to 4 years in small natal streams and then migrate through the larger rivers, lakes, and reservoirs to Puget Sound and the Pacific Ocean. Bull trout exhibit resident and migratory life history strategies through much of the current range (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear from one to four years before migrating to either a lake (adfluvial), river (fluvial), or in certain coastal areas, to saltwater (anadromous), where maturity is reached in one of the three habitats (Fraley and Shepard 1989; Goetz 1989). Resident and migratory forms may be found together and it is suspected that bull trout give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993).

In some stocks of bull trout, maturing adults may begin migrating to the spawning grounds in the spring or early summer. Female bull trout may deposit up to 5,000 or 10,000 eggs in the redds they build, depending on their size. The embryos incubate during the fall, winter, and spring; and the surviving fry emerge from the redds in April and May. The rate of embryo development is dependent upon temperature. After they emerge, the young bull trout disperse up and down stream to find suitable areas to feed. Feeding areas for Coastal/Puget Sound bull trout include estuaries and nearshore marine waters. Young fish feed primarily on aquatic invertebrates in the streams during their first 2 or 3 years but become more piscivorous as they get larger.

Bull trout have more specific habitat requirements compared to other salmonids (Rieman and McIntyre 1993). Habitat components that appear to influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors (Pratt 1992; Fraley and Shepard 1989; Goetz 1989; Sedell and Everest 1991; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Bull trout are seldom found in waters where temperatures exceed 59-64 °F (USFWS 2008). Bull trout typically spawn from August to November during periods of decreasing water temperatures. However, migratory bull trout frequently begin spawning migrations as early as April. Bull trout require spawning substrate consisting of loose, clean gravel relatively free of fine sediments (Fraley and Shepard 1989). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992, Ratliff and Howell 1992).

Species Baseline within Action Area

WDFW identifies 80 bull trout/Dolly Varden populations in Washington: 14 (18 percent) were healthy; two (3 percent) were in poor condition; six (8 percent) were critical and the status of 58 (72 percent) of the stocks were unknown (WDFW 2004). Native char (either bull trout or Dolly Varden) are rare in Lake Sammamish or its tributaries (NMFS 1999). No bull trout were observed during a one-year creel survey conducted on Lake Sammamish, and only a single bull trout was recorded during a two-year creel survey on Lake Washington (Pfeiffer and Bradbury 1992). Bull trout are known to exhibit “pioneering” behavior, spawning in areas other than their native stream. Bear

Creek, a tributary to the Sammamish River downstream from Issaquah Creek and Lake Sammamish, is listed as “potential” bull trout habitat by the USFWS (Kerwin 2001). However, there is no known resident subpopulation of bull trout in Lake Sammamish or its tributaries.

In addition, Bull Trout are opportunistic foragers, and the USFWS considers the entire distribution area for Coho salmon to be potential foraging habitat for bull trout. Hence, mimicking the distribution of Coho salmon, bull trout are presumed to occupy the action area. However, based on general bull trout life histories and history of elevated water temperatures in Lake Sammamish and Issaquah Creek area during the summer months, it is unlikely that bull trout would be present within the Action Area during the time of construction.

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APPENDIX F

Justification for Species Absent from Action Area

Justification for Species Absent from Action Area

Federally protected species with population ranges overlapping the project action area, as reported by U.S. Fish and Wildlife Service IPaC system (USFWS 2021), include the species shown in the table below. These species are determined to be absent from the action area based upon the rationale provided below.

<i>Regulatory Agency</i>	<i>Common Name</i>	<i>Scientific Name</i>	<i>Federal Status</i>
USFWS	Marbled Murrelet	<i>Brachyramphus marmoratus</i>	Threatened
	Streaked Horned Lark	<i>Eremophila alpestris strigata</i>	Threatened
	Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	Threatened

MARBLED MURRELET (BRACHYRAMPHUS MARMORATUS)

The U.S. Fish and Wildlife Service displays the Marbled Murrelet as potentially occurring within the project action area (USFWS 2021). No Critical Habitat is designated within the action area.

Marbled Murrelet is a small seabird with a unique life history that requires adults to fly extensive distances from marine waters, where they forage exclusively, to mature and old growth forests in order to nest and raise their young. Mature coniferous forests are a habitat requirement for the reproductive behavior of Marbled Murrelet (Nelson et al 2006). Although the action area occurs within Zone 1 of the Marbled Murrelet conservation area (WDFW 2019), the subject site and the surrounding area are too suburban and agrarian, and lack the mature forests required by this species for reproduction. Marbled Murrelet live their entire life at sea, except to reproduce. Therefore, it is unlikely that Marbled Murrelet occur in the action area. Due to the lack of habitat requirements available in the action area, the project will have **no effect** on the Marbled Murrelet.

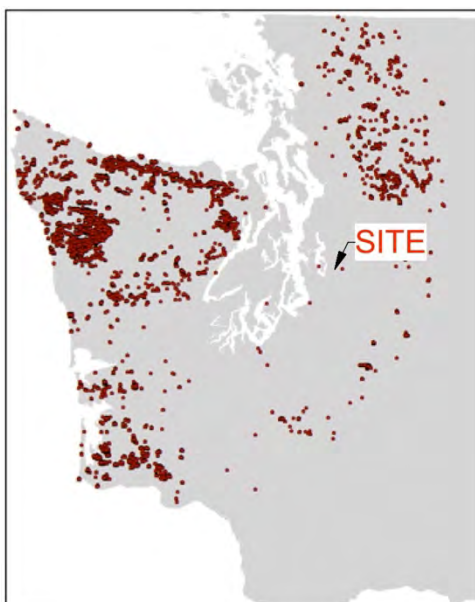


Figure 4 - Breeding season occurrences in Washington (Desimone 2016)

STREAKED HORNED LARK (*EREMOPHILA ALPESTRIS STRIGATA*)

The U.S. Fish and Wildlife Service lists the Streaked Horned Lark as potentially occurring within the project action area (USFWS 2021). No Critical Habitat is designated within the action area.

Streaked Horned Larks are grassland birds that historically have bred in the prairie and open coastal habitats of British Columbia, Washington, and Oregon. They are a rare subspecies of the horned lark, and prefer open grassland habitat. Streaked Horned Larks have been extirpated from much of their historic range. Recent research indicates that the Lark no longer breeds in southern British Columbia or the northern Puget trough (Stinson 2016). The current winter range of the lark appears to be concentrated in Oregon State, particularly in the Willamette Valley. Individuals occupying the southern Puget lowlands migrate to the Willamette Valley.

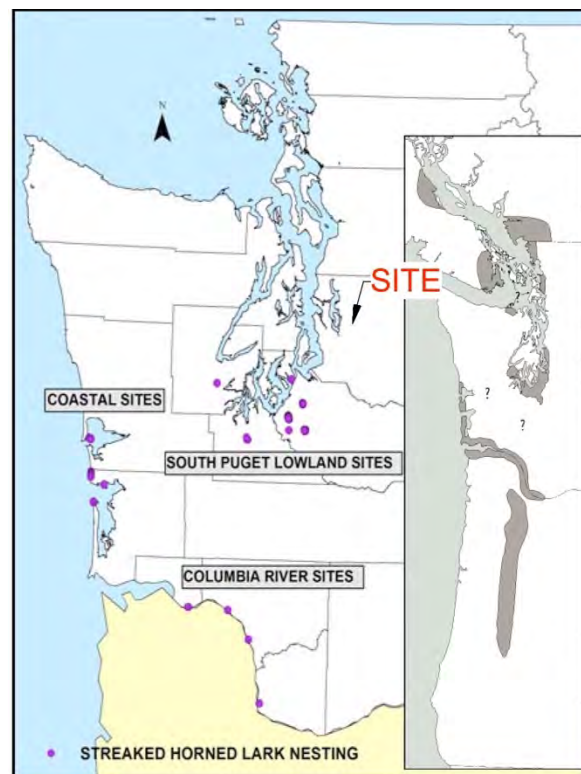


Figure 5 - Current Streaked Horned Lark breeding range, and hypothesized historic breeding range (in inset). (Stinson 2016)

According to the 2016 Periodic Status Review for the Streaked Horn Lark, this species no longer appears to utilize the northern portion of the Puget Sound trough (north of Pierce County) for either breeding or wintering (Stinson 2016). Thus, this project will have **no effect** on the Streaked Horned Lark.

YELLOW-BILLED CUCKOO (*COCCYZUS AMERICANUS*)

The U.S. Fish and Wildlife Service lists the Yellow-billed Cuckoo as potentially occurring within the project action area (USFWS 2021). No Critical Habitat is designated within the action area.

Yellow-billed Cuckoos strongly prefer continuous dense riparian habitat comprised of cottonwoods (*Populus balsamifera*) and willows (*Salix* spp.) (Hughes 1999). The project area lacks this habitat type.

The project is located along a riparian corridor associated with Issaquah Creek. However, this riparian corridor lacks the habitat type (cottonwoods, willows) and density that the Cuckoo prefers. This area is further surrounded by development. Yellow-billed cuckoos require relatively large continuous undisturbed patches of forested habitat with multiple strata, along streams or rivers. Therefore, it is highly unlikely that the Yellow-billed cuckoo inhabit the area.

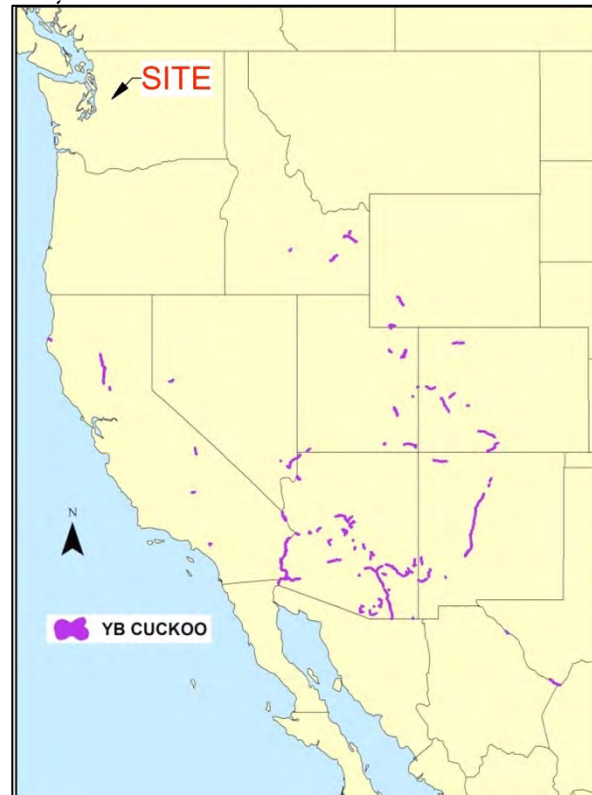


Figure 6 - Current breeding range of Western DPS Yellow-billed Cuckoo (Wiles et al. 2017)

Current breeding ranges in the U.S. are primarily within the central and eastern regions of the country. The Western U.S. Distinct Population Segment (DPS) is federally threatened. While the historic range extended into southern British Columbia, there have only been 20 sightings (non-breeding) since the 1950s in Washington State (most of which were in Eastern Washington) (Wiles et. al. 2017). The species is currently considered fully extirpated from the state of Washington. Thus, Yellow-billed Cuckoos are not considered to be present within the action area. The project will have **no effect** on the Yellow-billed Cuckoo.

APPENDIX G

Essential Fish Habitat (EFH)

Chinook Salmon West Coast States Essential Fish Habitat (EFH)

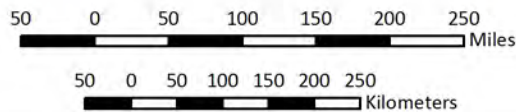
Salmonid EFH described in "Fisheries Off West Coast States; West Coast Salmon Fisheries; Amendment 18 to the Salmon Fishery Management Plan" published in the Federal Register / Vol. 79, No. 243/ Thursday, December 18, 2014.



- | | | | |
|-------------------|---------------------------|--------------------------|--------------------------------|
| ▲ Impassable Dam | Chinook Salmon EFH (2014) | Marine Salmon EFH (2014) | 4th Field Hydrologic Unit (HU) |
| * Natural Barrier | | | |



NOAA
FISHERIES



12/2014, C. Gavette Chinook_EFH_2014.mxd

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
WEST COAST REGION
777 Sonoma Ave., Room 325
SANTA ROSA, CALIFORNIA 95404

Coho Salmon West Coast States Essential Fish Habitat (EFH)

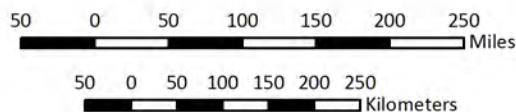
Salmonid EFH described in "Fisheries Off West Coast States; West Coast Salmon Fisheries; Amendment 18 to the Salmon Fishery Management Plan" published in the Federal Register / Vol. 79, No. 243/ Thursday, December 18, 2014.



▲ Impassable Dam Coho Salmon EFH (2014) Marine Salmon EFH (2014) 4th Field Hydrologic Unit (HU)



NOAA
FISHERIES

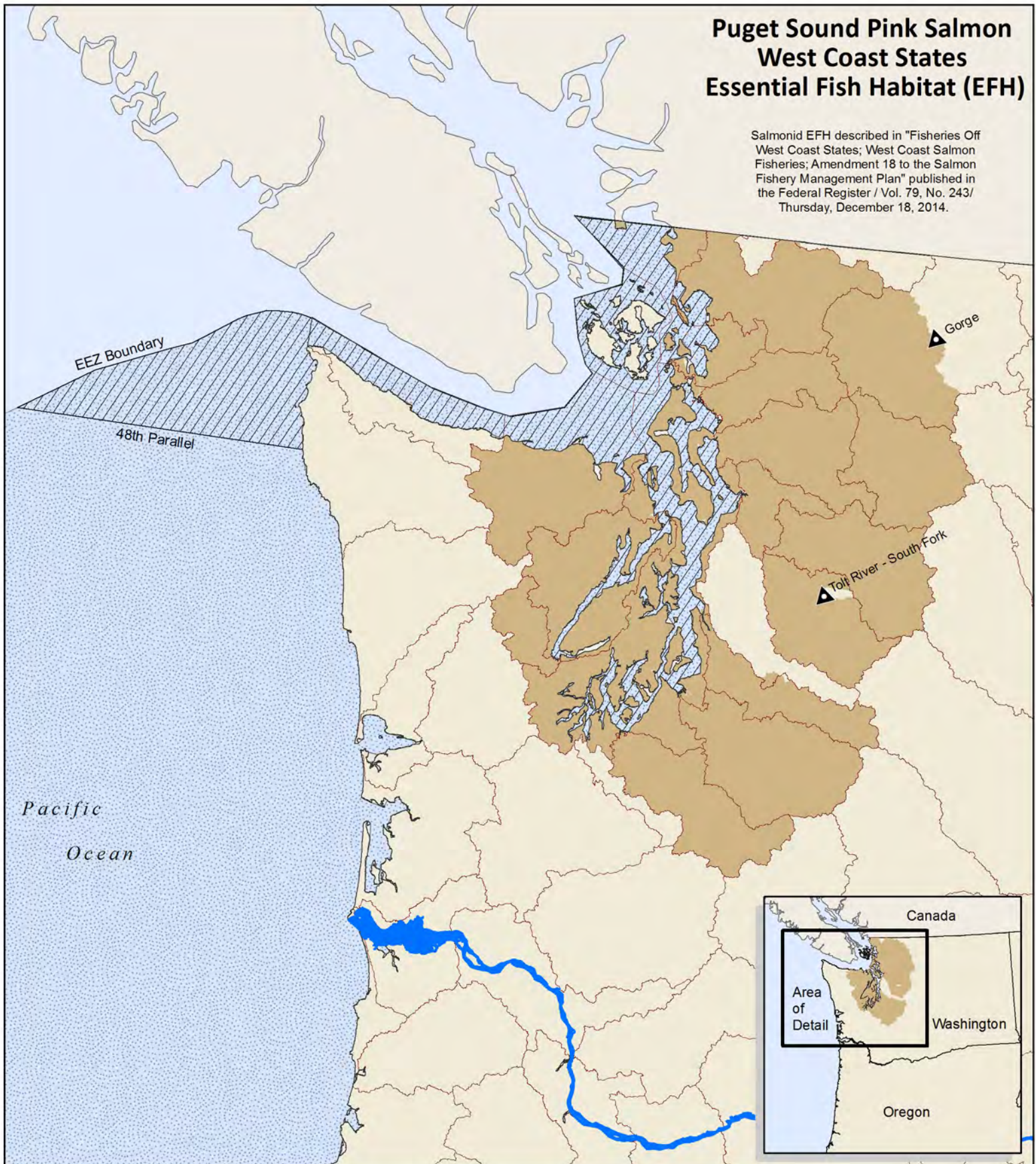


12/2014, C. Gavette Coho_EFH_2014.mxd

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National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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Puget Sound Pink Salmon West Coast States Essential Fish Habitat (EFH)

Salmonid EFH described in "Fisheries Off West Coast States; West Coast Salmon Fisheries; Amendment 18 to the Salmon Fishery Management Plan" published in the Federal Register / Vol. 79, No. 243/ Thursday, December 18, 2014.



▲ Impassable Dam
* Natural Barrier

Puget Sound Pink Salmon EFH (2014)

Puget Sound Pink Salmon Marine EFH (2014)

Marine Salmon EFH (2014)
4th Field Hydrologic Unit (HU)



NOAA
FISHERIES

10 0 10 20 30 40 50
Miles

10 0 10 20 30 40 50
Kilometers



12/2014, C. Gavette Pink_EFH_2014.mxd

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APPENDIX H

Site Plan

ISSAQUAH SCHOOL DISTRICT

HOLLY STREET CAMPUS - CREEK BANK REPAIR

CITY OF ISSAQUAH, WA

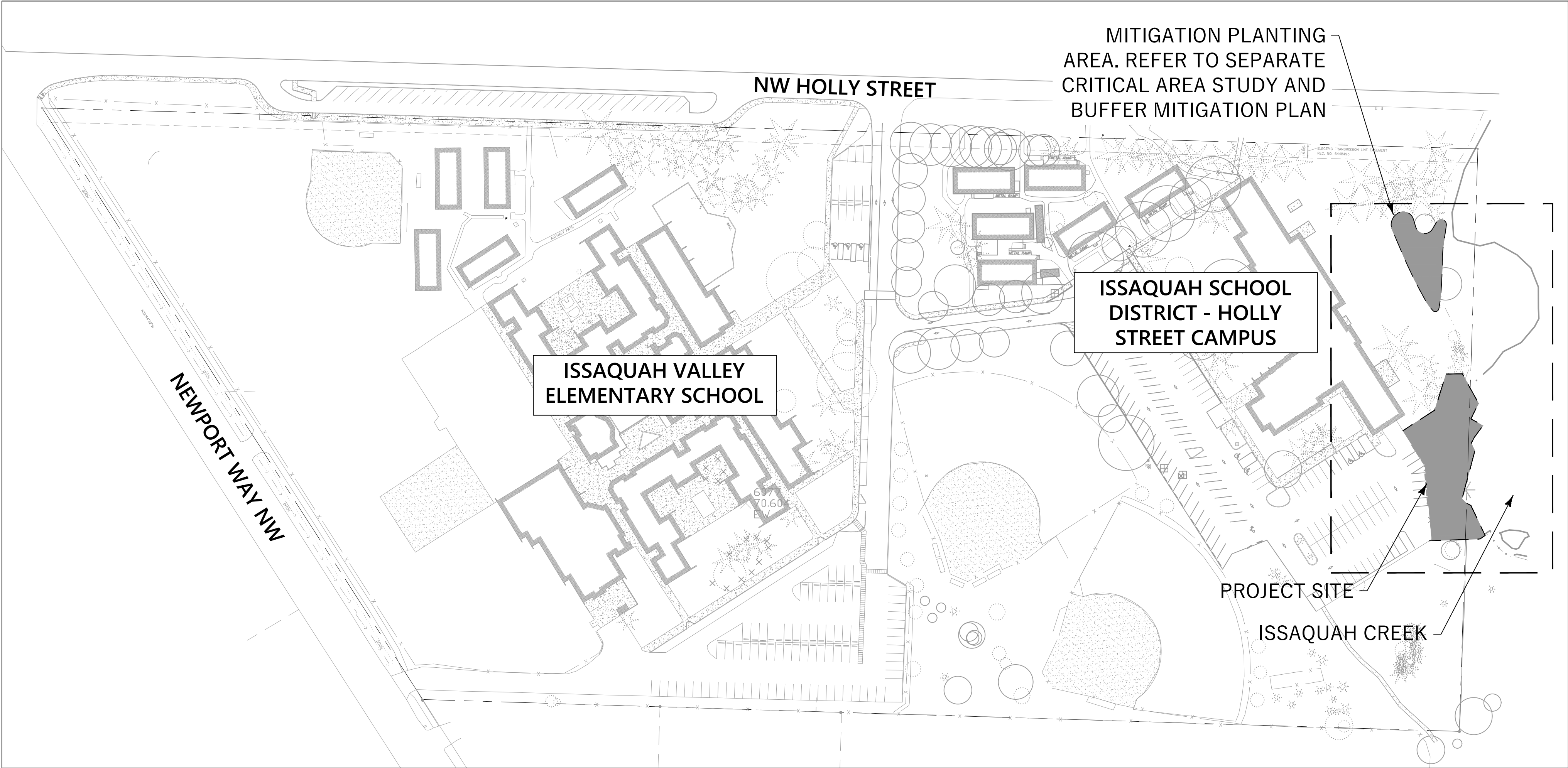
SITE WORK PERMIT

GENERAL NOTES

- ALL DESIGN AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH PERMIT CONDITIONS, THE ISSAQUAH MUNICIPAL CODE (IMC), THE ISSAQUAH PUBLIC WORKS STANDARDS AND THE CONDITIONS OF APPROVAL. IT SHALL BE THE SOLE RESPONSIBILITY OF THE APPLICANT/CONTRACTOR AND THE PROFESSIONAL CIVIL ENGINEER TO CORRECT ANY ERROR, OMISSION, OR DEVIATION FROM THE ABOVE REQUIREMENTS FOUND IN THESE PLANS. ALL CORRECTIONS SHALL BE AT NO ADDITIONAL COST OR LIABILITY TO THE CITY OF ISSAQUAH.
- THE DESIGN ELEMENTS WITHIN THESE PLANS HAVE BEEN REVIEWED ACCORDING TO THE CITY OF ISSAQUAH SITE WORK PERMIT SUBMITTAL REVIEW CHECKLIST. ANY DEVIATION FROM ADOPTED STANDARDS IS NOT ALLOWED UNLESS SPECIFICALLY APPROVED BY THE CITY IN WRITING PRIOR TO CONSTRUCTION.
- APPROVAL OF THIS PLAN DOES NOT CONSTITUTE AN APPROVAL OF UTILITIES NOT OWNED BY THE CITY (E.G. DOMESTIC WATER CONVEYANCE, SEWER CONVEYANCE, GAS, ELECTRICAL, ETC.).
- PRIOR TO ANY CONSTRUCTION OR DEVELOPMENT ACTIVITY, A PRECONSTRUCTION MEETING SHALL BE HELD BETWEEN THE CITY OF ISSAQUAH, THE APPLICANT(S), AND THE APPLICANT'S CONSTRUCTION REPRESENTATIVE.
- A COPY OF THESE APPROVED PLANS SHALL BE ON THE JOB SITE WHENEVER CONSTRUCTION IS IN PROGRESS.
- CONSTRUCTION HOURS ARE 7:00 AM TO 6:00 PM MONDAY THROUGH FRIDAY. WORK IS NOT ALLOWED ON SUNDAYS AND SOME HOLIDAYS IN ACCORDANCE WITH THE ISSAQUAH MUNICIPAL CODE. CONSTRUCTION IS NOT ALLOWED ON SATURDAY OR SUNDAY.
- IT SHALL BE THE APPLICANT'S/CONTRACTOR'S RESPONSIBILITY TO OBTAIN ALL NECESSARY CONSTRUCTION EASEMENTS BEFORE INITIATING ANY OFF-SITE WORK.
- DEWATERING (GROUNDWATER) SYSTEM CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CURRENT WSDOT STANDARD SPECIFICATIONS.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ADEQUATE SAFEGUARDS, SAFETY DEVICES, PROTECTIVE EQUIPMENT, FLAGGERS, AND ANY OTHER NEEDED ACTIONS TO PROTECT THE LIFE, HEALTH, AND SAFETY OF THE PUBLIC, AND TO PROTECT PROPERTY IN CONNECTION WITH THE PERFORMANCE OF WORK COVERED BY THE CONTRACTOR. ANY WORK WITHIN THE TRAVELED RIGHT-OF-WAY THAT MAY INTERRUPT NORMAL TRAFFIC FLOW MUST FOLLOW MUTCD. MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) SHALL APPLY. WORK IN RIGHT-OF-WAY IS NOT AUTHORIZED UNTIL A TRAFFIC CONTROL PLAN IS APPROVED BY THE CITY.
- ANY CHANGES TO THE APPROVED PLANS MAY REQUIRE A REVISION APPROVED BY THE CITY. NO CONSTRUCTION ON THESE CHANGES SHALL BEGIN UNTIL APPROVED BY THE CITY.
- PER RCW SECTION 19.122, CALL 811 BETWEEN TEN (10) AND TWO (2) BUSINESS DAYS TO ENSURE ANY UNDERGROUND UTILITIES ARE LOCATED PRIOR TO EXCAVATION BEFORE BEGINNING EXCAVATION WHERE ANY UNDERGROUND UTILITIES MAY BE LOCATED. FAILURE TO DO SO COULD MEAN BEARING SUBSTANTIAL REPAIR COSTS.
- APPROXIMATE LOCATIONS OF EXISTING UTILITIES HAVE BEEN OBTAINED FROM AVAILABLE RECORDS AND ARE SHOWN FOR CONVENIENCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF EXISTING UTILITY LOCATIONS WHETHER OR NOT THESE UTILITIES ARE SHOWN ON THE PLANS. THE CONTRACTOR SHALL EXERCISE ALL CARE TO AVOID DAMAGE TO ANY UTILITY. IF CONFLICTS WITH EXISTING UTILITIES ARISE DURING CONSTRUCTION, THE CONTRACTOR SHALL NOTIFY THE CITY OF ISSAQUAH SITE INSPECTOR AND ANY CHANGES REQUIRED SHALL BE APPROVED BY THE CITY OF ISSAQUAH SITE INSPECTOR PRIOR TO COMMENCEMENT OF RELATED CONSTRUCTION ON THE PROJECT. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT UTILITY LOCATES ARE MAINTAINED THROUGHOUT THE LIFE OF THE PROJECT.
- ALL DAMAGES INCURRED TO PUBLIC AND/OR PRIVATE PROPERTY BY THE CONTRACTOR DURING THE COURSE OF CONSTRUCTION SHALL BE PROMPTLY REPAIRED TO THE SATISFACTION OF THE COMMUNITY PLANNING AND DEVELOPMENT CONSTRUCTION INSPECTOR BEFORE PROJECT APPROVAL AND/OR THE RELEASE OF THE PROJECT'S PERFORMANCE BOND.
- ALL LANDSCAPED AREAS OF THE PROJECT SHALL INCLUDE A MINIMUM OF 8-INCHES OF COMPOSTED SOIL AMENDMENT ATOP A MINIMUM OF 4-INCHES SCARIFIED SOIL. LANDSCAPE AREAS SHALL BE SUBJECT TO AMENDMENTS IN ACCORDANCE WITH THE RESTORATION AND PLANTING PLAN.
- NO FINAL CUT OR FILL SLOPE SHALL EXCEED SLOPES OF TWO (2) HORIZONTAL TO ONE (1) VERTICAL WITHOUT STABILIZATION BY ROCKERY OR BY A STRUCTURAL RETAINING WALL, UNLESS DESIGNED AND COMPLETED UNDER THE SUPERVISION OF A LICENSED GEOTECHNICAL ENGINEER.
- THESE PLANS ARE APPROVED FOR STREAM BANK RESTORATION AND STANDARD DRAINAGE IMPROVEMENTS ONLY. STRUCTURES SUCH AS BRIDGES, VAULTS, AND RETAINING WALLS REQUIRE ADDITIONAL PERMITS FROM THE CITY PRIOR TO CONSTRUCTION.
- NO MATERIALS OR EQUIPMENT SHALL BE PLACED OR STORED ON PUBLIC RIGHT-OF-WAY AT ANY TIME.
- ANY CONSTRUCTION RESULTING IN A NEED FOR TRAFFIC CONTROL WITHIN THE PUBLIC RIGHT-OF-WAY SHALL REQUIRE A RIGHT-OF-WAY PERMIT APPROVED BY THE CITY.
- CONSTRUCTION NOISE SHALL BE LIMITED TO THE CONSTRUCTION HOURS AS STATED IN ISSAQUAH MUNICIPAL CODE.

VICINITY MAP

SCALE: 1"=80'



SITE AREA: ±12,400 SF

SHEET INDEX:

- C100 - COVER SHEET
- C110 - SPECIFICATIONS & NOTES
- C200 - TEMPORARY EROSION AND SEDIMENT CONTROL PLAN
- C210 - T.E.S.C DETAILS
- C300 - CONSTRUCTION SITE PLAN
- C310 - CONSTRUCTION DETAILS
- C311 - STREAM SECTIONS

SITE DATA SUMMARY:

PARCEL NUMBER: 2824069012

LEGAL DESCRIPTION:

THAT PORTION OF THE FOLLOWING DESCRIBED PROPERTY LYING EAST OF THE NEWPORT-ISSAQUAH ROAD AS CONVEYED TO KING COUNTY BY DEED RECORDED UNDER RECORDING NUMBER 856717:

THE SOUTH HALF OF THE NORTH HALF OF THE NORTHWEST QUARTER OF THE SOUTHEAST QUARTER; ALSO THE SOUTH 58.5 FEET OF THE EAST 336 FEET OF THE NORTHEAST QUARTER OF THE SOUTHWEST QUARTER, ALL IN SECTION 28, TOWNSHIP 24 NORTH, RANGE 6 EAST, WILLAMETTE MERIDIAN, IN KING COUNTY, WASHINGTON;

TOGETHER WITH THE NORTH HALF OF THE NORTH HALF OF THE NORTHWEST QUARTER OF THE SOUTHEAST QUARTER; ALSO THE NORTH 330 FEET OF THE EAST 336 FEET OF THE NORTHEAST QUARTER OF THE SOUTHWEST QUARTER, ALL IN SECTION 28, TOWNSHIP 24 NORTH, RANGE 6 EAST, WILLAMETTE MERIDIAN, IN KING COUNTY WASHINGTON;

EXCEPT THAT PORTION THEREOF AS DEEDED TO KING COUNTY FOR STREET PURPOSES BY DEED RECORDED UNDER RECORDING NUMBER 8008250588.

ADDRESS: 565 NW HOLLY ST, ISSAQUAH, WA 98027

GROSS SITE AREA: 841,186 SF (19.31 ACRES)

APPLICABLE CODE: 2012 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON, AS AMENDED IN DECEMBER 2014

ZONING: CF-F (COMMUNITY FACILITIES - FACILITIES)

EXISTING PERVIOUS SURFACE: N/A
EXISTING IMPERVIOUS SURFACE: N/A

PROPOSED PERVIOUS SURFACE: N/A
PROPOSED IMPERVIOUS SURFACE: N/A

CUBIC YARDS OF CUT: 450 CY
CUBIC YARDS OF FILL: 780 CY

PROJECT CONTACT INFORMATION:

OWNER

ISSAQUAH SCHOOL DISTRICT
5150 220TH AVE SE
ISSAQUAH, WA 98029

EMAIL: WALKERJ2@ISSAQUAH.WEDNET.EDU
PHONE: 425.306.4022
CONTACT: JANELLE WALKER

SURVEYOR

GROUP FOUR
16030 JUANITA-WOODINVILLE WAY NE
BOTHEL, WA 98011

PHONE: 425.775.4581
CONTACT: DANIEL ROUPE, PLS

CIVIL ENGINEER

LATITUDE 48 ENGINEERS
600 1ST AVENUE
SEATTLE, WA 98104

EMAIL: CHASEN@LATITUDE-48.COM
PHONE: 206.556.1615
CONTACT: CHASEN SIMPSON, PE

WETLAND ECOLOGIST

WETLAND RESOURCES, INC.
9505 19TH AVE SE #106
EVERETT, WA 98208

EMAIL: MERYL@WETLANDRESOURCES.COM
PHONE: 425.337.3174
CONTACT: MERYL KAMOWSKI

GEOTECHNICAL ENGINEER

NELSON GEOTECHNICAL ASSOCIATES, INC.
17311 135TH AVE. N.E. SUITE A-500
WOODINVILLE, WA 98072

EMAIL: KHALS@NELSONGEOTECH.COM
PHONE: 425.486.1669
CONTACT: KHAL M. SHAWISH, PE



ISD HOLLY STREET CAMPUS

PERMANENT CREEK REPAIR

565 NW HOLLY STREET
ISSAQUAH, WA 98027

NO.	REVISION / ISSUE	DATE

OWNER:

ISSAQUAH SCHOOL DISTRICT
5150 220TH AVE SE
ISSAQUAH, WA 98029

CONTACT: JANELLE WALKER
PHONE: 425.306.4022

GEOTECHNICAL ENGINEER:

NELSON GEOTECHNICAL ASSOCIATES
17311 135TH AVE. N.E. SUITE A-500
WOODINVILLE, WA 98072

CONTACT: KHAL M. SHAWISH, PE
PHONE: 425.486.1669

PROJECT: 2020-19	SHEET:
DATE: 2021.10.22	C-100
SCALE: SEE PLAN	

COVER SHEET

SPECIFICATIONS

ALL WORK PERFORMED UNDER THESE CONTRACT DOCUMENTS SHALL BE IN ACCORDANCE WITH THE STATE OF WASHINGTON STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION, M41-10, MOST RECENT VERSION. IN THE EVENT OF A CONFLICT BETWEEN THE FOLLOWING ATTACHED SPECIFICATIONS AND THE STATE OF WASHINGTON STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION, M41-10, THE ATTACHED SPECIFICATIONS ON THIS SHEET FOR THIS CONTRACT SHALL PREVAIL. SPECIAL PROVISIONS SHALL FOLLOW AND THEN THE WSDOT M41-10. THE FOLLOWING MOST CURRENT PROVISIONS, CODES AND SPECIFIC MATERIAL AND WORKMANSHIP SPECIFICATIONS ARE ATTACHED TO THIS CONTRACT AND SHALL BE ADHERED TO:

AAWA	ARCHITECTURAL ALUMINUM MANUFACTURES' ASSOCIATION
ACI	AMERICAN CONCRETE INSTITUTE
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APA	AMERICAN PLYWOOD ASSOCIATION
APWA	AMERICAN PUBLIC WORKS ASSOCIATION
AREA	AMERICAN RAILWAY ENGINEERING ASSOCIATION
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING OF MATERIALS
AWPA	AMERICAN WOOD PRESERVERS ASSOCIATION
AWS	AMERICAN WELDING SOCIETY
AWWA	AMERICAN WATER WORKS ASSOCIATION
WSDOT	WASHINGTON STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION, M41-10

ITEMS IN SPECIFICATIONS
CERTAIN ITEMS DESCRIBED IN THE SPECIFICATION MAY NOT BE UTILIZED IN THIS PROJECT BUT ARE LISTED AS GENERAL ITEMS AND MAY OR MAY NOT APPLY SPECIFICALLY TO THIS PROJECT.

ALTERNATES
ALTERNATIVE MATERIALS AND CONSTRUCTION METHODS ARE ACCEPTABLE. THE OVERALL SIZE AND CONCEPT OF THE PROJECT SHALL BE UNCHANGED. ALTERNATE METHODS OF CONSTRUCTION AND ANY DIMENSIONAL ALTERNATES SHALL BE PROVIDED IN WRITING FOR APPROVAL BY THE ENGINEER, PRIOR TO INSTALLATION. CHANGES IN COST ASSOCIATED WITH ALTERNATES SHALL BE AT THE RISK OF THE CONTRACTOR. ANY ALTERNATES INSTALLED WITHOUT PRIOR WRITTEN APPROVAL MAY BE REMOVED AND REPLACED AT THE DISCRETION OF THE ENGINEER AT NO COST TO THE OWNER.

SUBMITTALS
SUBMITTALS FOR APPURTENANCES INSTALLED UNDER THIS CONTRACT SHALL BE PROVIDED TO THE ENGINEER PRIOR TO INSTALLATION FOR APPROVAL. THE FOLLOWING NOTES APPLY UNLESS INDICATED OTHERWISE:

SPECIAL INSPECTION, AS NOTED SHALL BE PROVIDED BY THE OWNER'S REPRESENTATIVE.

CRUSHED GRAVEL SURFACING
CRUSHED GRAVEL SURFACING SHALL MEET WSDOT SPEC. 9-03.9(3) FOR CRUSHED SURFACING ROCK AND SHALL MEET WSDOT SPEC. 9-03.9(3) FOR BASE COURSE OR TOP COARSE AS INDICATED ON THE DRAWINGS.

RIPRAP
WSDOT SPEC. 9-13.1(2) LIGHT LOOSE RIP RAP.

QUARRY SPALLS
QUARRY SPALLS SHALL BE WSDOT 9-13.6

FISH MIX
FISH MIX GRAVEL SHALL CONSIST OF WASHED ROUND RIVER GRAVEL CONSISTING BY VOLUME OF 60% SAND TO 2" ROCK, AS PER WSDOT 9-03.11(1) STREAMBED SEDIMENT AND 20% 2" TO 6" ROCK, PER WSDOT 9-03.11(2) STREAMBED COBBLES AND 20% 6" TO 18" ROCK AS WSDOT 9-03.11(2) STREAMBED COBBLES. FISH MIX SHALL BE SUPPLEMENTED AS NECESSARY WITH NATIVE BED MATERIAL AND/OR IMPORTED PIT RUN IN ORDER TO MATCH EXISTING BED MATERIAL GRADATION AND PREVENT SUBSURFACE FLOW. ALL FISH MIX GRAVEL SHALL BE APPROVED IN WRITING BY THE ENGINEER AT THE GRAVEL PIT PRIOR TO DELIVERY OF SITE.

ANCHOR BOLTS
ANCHOR BOLTS SHALL BE HOT DIPPED GALVANIZED ASTM A307. SET ALL ANCHOR BOLTS BY TEMPLATE OR DRILLED IN EPOXY AT 7 DAYS POST CONCRETE PLACEMENT.

ADHESIVE ANCHORS
"HIT HY-200 OR 200 R" BY HILTI INC.,SIMPSON SET-XP OR AT-XP10, USE HDG A36 OR A307 THREADED ROD. ICBO CERTIFICATION REQUIRED. SPECIAL INSPECTION REQUIRED.

DRILL IN EXPANSION BOLTS NOT ALLOWED
EXPANSION ANCHORS NOT ALLOWED. "KWIK-BOLTS" BY HILTI FASTENING SYSTEMS, "PARABOLTS" BY USM CORP, "RED HEAD WEDGE ANCHOR" BY ITT PHILLIPS NOT ALLOWED.

REVEGETATION WHERE APPLICABLE
REVEGETATE ALL DISTURBED AREAS OF CONSTRUCTION. REPLANT RIPARIAN AREAS AS FOLLOWS: RED OSIER DOGWOOD AND WILLOW (SALIX SPP.) SHALL BE LIVE STAKED ALONG THE WATERS EDGE AT 2'-0" ON CENTER FOR 4 ROWS BACK FROM ANTICIPATED ORDINARY HIGH WATER (OHW) EDGE. DISTURBED AREAS 10' FROM OHW EDGE SHALL BE REPLANTED AS FOLLOWS: WESTERN RED CEDAR, BLACK COTTONWOOD AND DOUGLAS FIR SHALL BE INTERSPERSED AND PLANTED AS PULL UPS WITH ROOTS IN SOIL THROUGHOUT DISTURBED UPLAND AREAS @ 25' O.C.. EROSION CONTROL SEED MIXTURE APPROPRIATE FOR LOCAL SHALL BE HAND BROADCAST OR HYDROSEEDDED IN ALL UPLAND DISTURBED AREAS.

STREAMBED COBBLES AND BOULDERS
STREAMBED ROCK INCLUDING COBBLES AND BOULDERS SHALL BE IN CONFORMANCE WITH WSDOT SPEC. 9-03.11(2) AND 9-03.11(3). ROCK SIZE SHALL BE AS INDICATED ON THE PLANS AND SHALL BE AS FOUND IN A NATURALLY OCCURRING FLUVIAL SEDIMENT AND SHALL BE ROUNDED OR SEMI-ROUNDED.

EROSION CONTROL SEED MIXTURE
EROSION CONTROL SEED MIXTURE SHALL CONSIST OF 20% WHITE CLOVER, 20% ANNUAL RYE, 60% CREEPING RED FESCUE.

ROOTWADS AND LARGE WOODY DEBRIS (LWD)
ROOTWADS AND LARGE ORGANIC DEBRIS SHALL BE UTILIZED FROM LIVE TREES AND SHALL HAVE A MINIMUM OF 30 FEET OF TREE STEM INTEGRAL WITH THE ROOTS UNO. LWD SHALL BE FROM LIVE OR RECENTLY LIVE WOOD. ALL LWD SHALL HAVE A MINIMUM DIAMETER OF 10" AT THE SMALL TAPERED END UNO. LWD SHALL BE DOUGLAS FIR OR WESTERN RED CEDAR UNLESS OTHERWISE APPROVED BY PROJECT ENGINEER. ANCHOR HABITAT BOULDERS SHALL BE 2, 3 AND 4 MAN ROCKS AS PER WSDOT AND AS NOTED ON THE PLANS. ALL ANCHORAGE SHALL BE FASTENED USING 3/8"-19 MINIMUM DIAMETER GALVANIZED OR STAINLESS STEEL CABLE OR HDG 3/8" α STEEL CHAIN AS INDICATED ON THE DRAWINGS. ALL CHAIN AND CABLE SHALL BE FASTENED WITH HDG STEEL CLAMPS AND LIBERAL QUANTITIES OF HDG 3/8"X4" STEEL STAPLES.

TEMPORARY EROSION AND SEDIMENT CONTROL NOTES

- TEMPORARY EROSION AND SEDIMENT CONTROL NOTES
1. APPROVAL OF THIS ESC PLAN DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT ROAD OR DRAINAGE DESIGN (E.G., SIZE AND LOCATION OF ROADS, PIPES, RESTRICTORS, CHANNELS, RETENTION FACILITIES, UTILITIES, ETC.).
 2. THE IMPLEMENTATION OF THIS ESC PLAN AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE APPLICANT/ESC SUPERVISOR UNTIL ALL CONSTRUCTION IS APPROVED.
 3. THE BOUNDARIES OF THE CLEARING LIMITS SHOWN ON THIS PLAN SHALL BE CLEARLY FLAGGED BY SURVEY TAPE OR FENCING, PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, DISTURBANCE BEYOND THE CLEARING LIMITS IS NOT PERMITTED. THE CLEARING LIMITS SHALL BE MAINTAINED BY THE APPLICANT/ESC SUPERVISOR FOR THE DURATION OF CONSTRUCTION.
 4. STABILIZED CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES, SUCH AS CONSTRUCTED WHEEL WASH SYSTEMS OR WASH PADS, MAY BE REQUIRED TO ENSURE THAT ALL PAVED AREAS ARE KEPT CLEAN AND TRACK OUT TO ROAD RIGHT—OF—WAY DOES NOT OCCUR FOR THE DURATION OF THE PROJECT.
 5. THE ESC FACILITIES SHOWN ON THIS PLAN MUST BE CONSTRUCTED PRIOR TO OR IN CONJUNCTION WITH ALL CLEARING AND GRADING SO AS TO ENSURE THAT THE TRANSPORT OF SEDIMENT TO SURFACE WATERS, DRAINAGE SYSTEMS, FLOW CONTROL BMP LOCATIONS (EXISTING AND PROPOSED), AND ADJACENT PROPERTIES IS MINIMIZED.
 6. THE ESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC FACILITIES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND MODIFIED TO ACCOUNT FOR CHANGING SITE CONDITIONS (E.G., ADDITIONAL COVER MEASURES, ADDITIONAL SUMP PUMPS, RELOCATION OF DITCHES AND SILT FENCES, PERIMETER PROTECTION ETC.) OR AS DIRECTED BY THE CITY.
 7. THE ESC FACILITIES SHALL BE INSPECTED DAILY BY THE APPLICANT/ESC SUPERVISOR DURING NON—RAINFALL PERIODS, EVERY HOUR (DAYLIGHT) DURING A RAINFALL EVENT, AND AT THE END OF EVERY RAINFALL, AND MAINTAINED TO ENSURE THEIR CONTINUED PROPER FUNCTIONING. IN ADDITION, TEMPORARY SILTATION PONDS AND ALL TEMPORARY SILTATION CONTROLS SHALL BE MAINTAINED IN A SATISFACTORY CONDITION UNTIL SUCH TIME THAT CLEARING AND/OR CONSTRUCTION IS COMPLETED, PERMANENT DRAINAGE FACILITIES ARE OPERATIONAL, AND THE POTENTIAL FOR EROSION HAS PASSED. WRITTEN RECORDS SHALL BE KEPT OF WEEKLY REVIEWS OF THE ESC FACILITIES DURING THE WET SEASON (OCT. 1 TO APRIL 30) AND OF MONTHLY REVIEWS DURING THE DRY SEASON (MAY 1 TO SEPT 30).
 8. ANY AREAS OF EXPOSED SOILS, INCLUDING ROADWAY EMBANKMENTS, THAT WILL NOT BE DISTURBED FOR TWO CONSECUTIVE DAYS DURING THE WET SEASON OR SEVEN DAYS DURING THE DRY SEASON SHALL BE IMMEDIATELY STABILIZED WITH THE APPROVED ESC COVER METHODS (E.G., SEEDING, MULCHING, PLASTIC COVERING, ETC.).
 9. ANY AREA NEEDING ESC MEASURES THAT DO NOT REQUIRE IMMEDIATE ATTENTION SHALL BE ADDRESSED WITHIN SEVEN (7) DAYS.
 10. THE ESC FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH (MORE FREQUENTLY AS REQUIRED BY THE PUBLIC WORKS CONSTRUCTION INSPECTOR) OR WITHIN TWENTY—FOUR (24) HOURS FOLLOWING A STORM EVENT.
 11. AT NO TIME SHALL MORE THAN ONE (1) FOOT OF SEDIMENT BE ALLOWED TO ACCUMULATE WITHIN A CATCH BASIN. ALL CATCH BASINS AND CONVEYANCE LINES SHALL BE CLEANED PRIOR TO PAVING. THE CLEANING OPERATION SHALL NOT FLUSH SEDIMENT—LADEN WATER INTO THE DOWNSTREAM SYSTEM.
 12. ANY PERMANENT RETENTION/DETENTION FACILITY USED AS A TEMPORARY SETTLING BASIN SHALL BE MODIFIED WITH THE NECESSARY EROSION CONTROL MEASURES AND SHALL PROVIDE ADEQUATE STORAGE CAPACITY. IF THE FACILITY IS TO FUNCTION ULTIMATELY AS AN INFILTRATION SYSTEM, THE PERMANENT FACILITY SHALL NOT BE USED AS A TEMPORARY SETTLING BASIN, ELSE THE TEMPORARY FACILITY MUST BE GRADED SO THAT THE BOTTOM AND SIDES ARE AT LEAST THREE FEET ABOVE THE FINAL GRADE OF THE PERMANENT FACILITY. NO UNDERGROUND DETENTION TANK, DETENTION VAULT, OR SYSTEM WHICH BACKS UNDER OR INTO A POND SHALL BE USED AS A TEMPORARY SETTLING BASIN. FLOW CONTROL BMP AREAS (EXISTING OR PROPOSED) SHALL NOT BE USED AS TEMPORARY FACILITIES AND SHALL BE PROTECTED FROM SEDIMENTATION AND INTRUSION.
 13. COVER MEASURES WILL BE APPLIED IN CONFORMANCE WITH APPENDIX D OF THE 2019 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON (ECOLOGY).
 14. PRIOR TO THE BEGINNING OF THE WET SEASON (OCTOBER 1) OF EACH YEAR, ALL DISTURBED AREAS SHALL BE REVIEWED TO IDENTIFY WHICH ONES CAN BE SEEDD IN PREPARATION FOR THE WINTER RAINS. THE IDENTIFIED DISTURBED AREA SHALL BE SEEDD WITHIN ONE WEEK AFTER OCTOBER 1. A SKETCH MAP DEPICTING THE AREAS TO BE SEEDD AND THE AREAS TO REMAIN UNCOVERED SHALL BE SUBMITTED TO THE PUBLIC WORKS CONSTRUCTION INSPECTOR. THE INSPECTOR MAY REQUIRE SEEDING OF ADDITIONAL AREAS IN ORDER TO PROTECT SURFACE WATERS, ADJACENT PROPERTIES, OR DRAINAGE FACILITIES.
 15. ALL EROSION/SEDIMENTATION CONTROL PONDS WITH A DEAD STORAGE DEPTH EXCEEDING SIX INCHES (6") MUST HAVE A HIGHLY VISIBLE PERIMETER FENCE WITH A MINIMUM HEIGHT OF THREE FEET (3').
 16. ALL LOTS ADJOINING OR HAVING ANY NATIVE GROWTH PROTECTION EASEMENTS (NGPE) OR SENSITIVE AREA TRACT SHALL HAVE A MINIMUM FOUR—FOOT (4') HIGH TEMPORARY CONSTRUCTION FENCE (CYCLONE OR PLASTIC MESH) SEPARATING THE LOT (OR BUILDABLE PORTIONS OF THE LOT) FROM THE AREA RESTRICTED BY THE NGPE AND SHALL BE INSTALLED PRIOR TO ANY GRADING OR CLEARING AND REMAIN IN PLACE UNTIL A DWELLING IS CONSTRUCTED AND OWNERSHIP TRANSFERRED TO THE FIRST OWNER/OCCUPANT. CLEARING LIMITS SHALL BE Delineated WITH A CLEARING CONTROL FENCE. THE CLEARING CONTROL FENCE SHALL CONSIST OF A FOUR—FOOT (4') HIGH TEMPORARY CONSTRUCTION FENCE. CLEARING CONTROL FENCES ALONG WETLAND OR STREAM BUFFERS OR UPSLOPE OF SENSITIVE SLOPES SHALL BE ACCOMPANIED BY TWO ROWS OF EROSION CONTROL FENCE. IF DETERMINED APPROPRIATE BY CITY OF ISSAQUAH A SIX—FOOT (6') HIGH CHAIN LINK FENCE MAY BE REQUIRED.
 17. IF SEDIMENT IS TRACKED OFFSITE, PUBLIC ROADS SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY, OR MORE FREQUENTLY DURING WET WEATHER, IF NECESSARY TO PREVENT SEDIMENT FROM ENTERING WATERS OF THE STATE. SEDIMENT SHALL BE REMOVED FROM ROADS BY SHOVELING OR PICKUP SWEEPING AND SHALL BE TRANSPORTED TO A CONTROLLED SEDIMENT DISPOSAL AREA. STREET WASHING WILL BE ALLOWED ONLY AFTER SEDIMENT IS REMOVED IN THIS MANNER. STREET WASH WASTEWATER SHALL BE CONTROLLED BY PUMPING BACK ONSITE, OR OTHERWISE BE PREVENTED FROM DISCHARGING INTO DRAINAGE SYSTEMS TRIBUTARY TO SURFACE WATERS.
 18. ANY CATCH BASINS COLLECTING RUNOFF FROM THE SITE, WHETHER THEY ARE ON OR OFF THE SITE, SHALL HAVE THEIR GRATES COVERED WITH FILTER FABRIC DURING CONSTRUCTION. CATCH BASINS DIRECTLY DOWNSTREAM OF THE CONSTRUCTION ENTRANCE OR ANY OTHER CATCH BASIN AS DETERMINED BY THE PUBLIC WORKS CONSTRUCTION INSPECTOR SHALL BE PROTECTED WITH A 'FILTER FABRIC SOCK' OR EQUIVALENT. AT NO TIME SHALL MORE SEDIMENT THAN ONE—THIRD (1/3) OF THE AVAILABLE STORAGE BE ALLOWED TO ACCUMULATE WITHIN A CATCH BASIN INSERT.
 20. THE WASHED GRAVEL BACKFILL ADJACENT TO THE FILTER FABRIC FENCE SHALL BE REPLACED AND THE FILTER FABRIC CLEANED IF IT IS NONFUNCTIONAL BY EXCESSIVE SILT ACCUMULATION AS DETERMINED BY THE CITY OF ISSAQUAH PUBLIC WORKS CONSTRUCTION INSPECTOR. ALL INTERCEPT SWALES SHALL BE CLEANED IF SILT ACCUMULATION EXCEEDS ONE—HALF FOOT (0.5') DEPTH.
 21. ROCK FOR EROSION PROTECTION OF ROADWAY DITCHES, WHERE REQUIRED, MUST BE OF SOUND QUARRY ROCK, PLACED TO A DEPTH OF 1' AND MUST MEET WSDOT SPECIFICATIONS 4"-8" ROCK/40%-70% PASSING; 2"-4" ROCK/30%-40% PASSING; AND 1"-2" ROCK/10%-20% PASSING.
 22. FLUSHING CONCRETE BY—PRODUCTS OR TRUCKS NEAR OR INTO THE STORM DRAINAGE SYSTEM SHALL NOT BE ALLOWED. IF EXPOSED AGGREGATE IS FLUSHED INTO THE STORM SYSTEM, IT MAY RESULT IN RE—INSPECTION AND RE—CLEANING THE ENTIRE AFFECTED DOWNSTREAM STORM SYSTEM, OR POSSIBLY RE—LAYING THE STORM LINE.
 23. MAXIMUM RELEASE RATE FROM THE SITE AT ANY TIME DURING CONSTRUCTION AND DURING THE MAINTENANCE AND DEFECT PERIOD SHALL BE NO MORE THAN ONE—HALF OF THE 2—YEAR PEAK FLOW WHEN THE FLOW CONTROL STRUCTURE IS BYPASSED.
 24. DURING THE WET SEASON (OCTOBER 1 — APRIL 30) NOTES:
 - A. THE ALLOWED TIME THAT A DISTURBED AREA MAY REMAIN UNWORKED WITHOUT COVER MEASURES IS REDUCED TO TWO CONSECUTIVE WORKING DAYS, RATHER THAN SEVEN (SECTION D.2.1.2).
 - B. STOCKPILES AND STEEP CUT AND FILL SLOPES ARE TO BE PROTECTED IF UNWORKED FOR MORE THAN 12 HOURS (SECTION D.2.1.2).
 - C. COVER MATERIALS SUFFICIENT TO COVER ALL DISTURBED AREAS SHALL BE STOCKPILED ON SITE (SECTION D.2.1.2).
 - D. ALL AREAS THAT ARE TO BE UNWORKED DURING THE WET SEASON SHALL BE SEEDD WITHIN ONE WEEK OF THE BEGINNING OF THE WET SEASON (SECTION D.2.1.2.6).
 - E. MULCH IS REQUIRED TO PROTECT ALL SEEDD AREAS (SECTION D.2.1.2.2).
 - F. FIFTY LINEAR FEET OF SILT FENCE (AND THE NECESSARY STAKES) PER ACRE OF DISTURBANCE MUST BE STOCKPILED ON SITE (SECTION D.2.1.3.1).
 - G. CONSTRUCTION ROAD AND PARKING LOT STABILIZATION ARE REQUIRED FOR ALL SITES UNLESS THE SITE IS UNDERLAIN BY COARSE—GRAINED SOIL (SECTION D.2.1.4.2).
 - H. SEDIMENT RETENTION IS REQUIRED UNLESS NO OFFSITE DISCHARGE IS ANTICIPATED FOR THE SPECIFIED DESIGN FLOW (SECTION D.2.1.5).
 - I. SURFACE WATER CONTROLS ARE REQUIRED UNLESS NO OFFSITE DISCHARGE IS ANTICIPATED FOR THE SPECIFIED DESIGN FLOW (SECTION D.2.1.6).
 - J. PHASING AND MORE CONSERVATIVE BMPS MUST BE EVALUATED FOR CONSTRUCTION ACTIVITY NEAR SURFACE WATERS (SECTION D.2.4.3).
 - K. ANY RUNOFF GENERATED BY DEWATERING MAY BE REQUIRED TO DISCHARGE TO THE SANITARY SEWER (WITH APPROPRIATE DISCHARGE AUTHORIZATION), PORTABLE SAND FILTER SYSTEMS, OR HOLDING TANKS (SECTION D.2.2).
 - L. WHEN LOCATED WITHIN AN ENVIRONMENTALLY CRITICAL AREA, A WET SEASON PERMIT IS REQUIRED.

MONITORING PROGRAM

MONITORING OF THE PROJECT AFTER CONSTRUCTION SHALL BE IN ACCORDANCE WITH PROGRAMMATIC REQUIREMENTS BY FEMA AND THOSE OF THE ARMY CORPS OF ENGINEERS. A SUMMARY OF RECOMMENDED LONG-TERM MONITORING ACTIVITIES IS PRESENTED IN THE TABLE BELOW:

LONG TERM MONITORING PROGRAM			
MOINTORING GOAL	METRIC	MONITORING FREQUENCY	TIMING
- LOCAL IMPACTS - LWD REMAINS IN-TACT	- QUALITATIVE GEOMORPHIC OBSERVATIONS -MEASURED CROSS SECTIONS	ANNUALLY, FIVE YEARS	EARLY LOW-FLOW EVENT
- 60% PLANT SURVIVAL -80% PLANT COVERAGE	- PLANTING SURVEY	ANNUALLY, THREE YEARS	GROWING SEASON END
- STABILITY DURING HIGH FLOW - HIGH FLOW HYDROLOGY	- VIDEO RECORDS - QUALITATIVE GEOMORPHIC OBSERVATIONS	AS NEEDED, FIVE YEARS+	>2-YEAR HIGH-FLOW EVENTS



ISD HOLLY STREET CAMPUS
PERMANENT CREEK REPAIR
565 NW HOLLY STREET
ISSAQUAH, WA 98027

NO.	REVISION / ISSUE	DATE

OWNER:
ISSAQUAH SCHOOL DISTRICT
5150 220TH AVE SE
ISSAQUAH, WA 98029

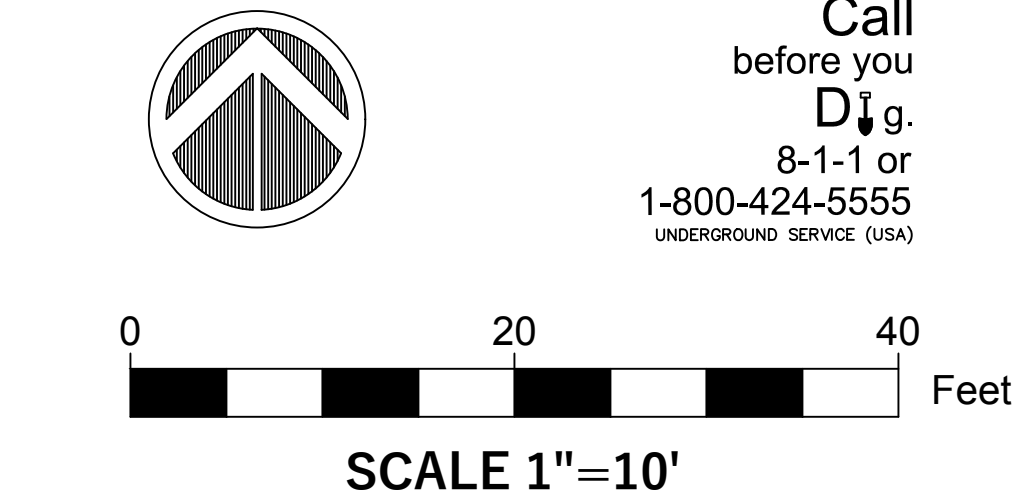
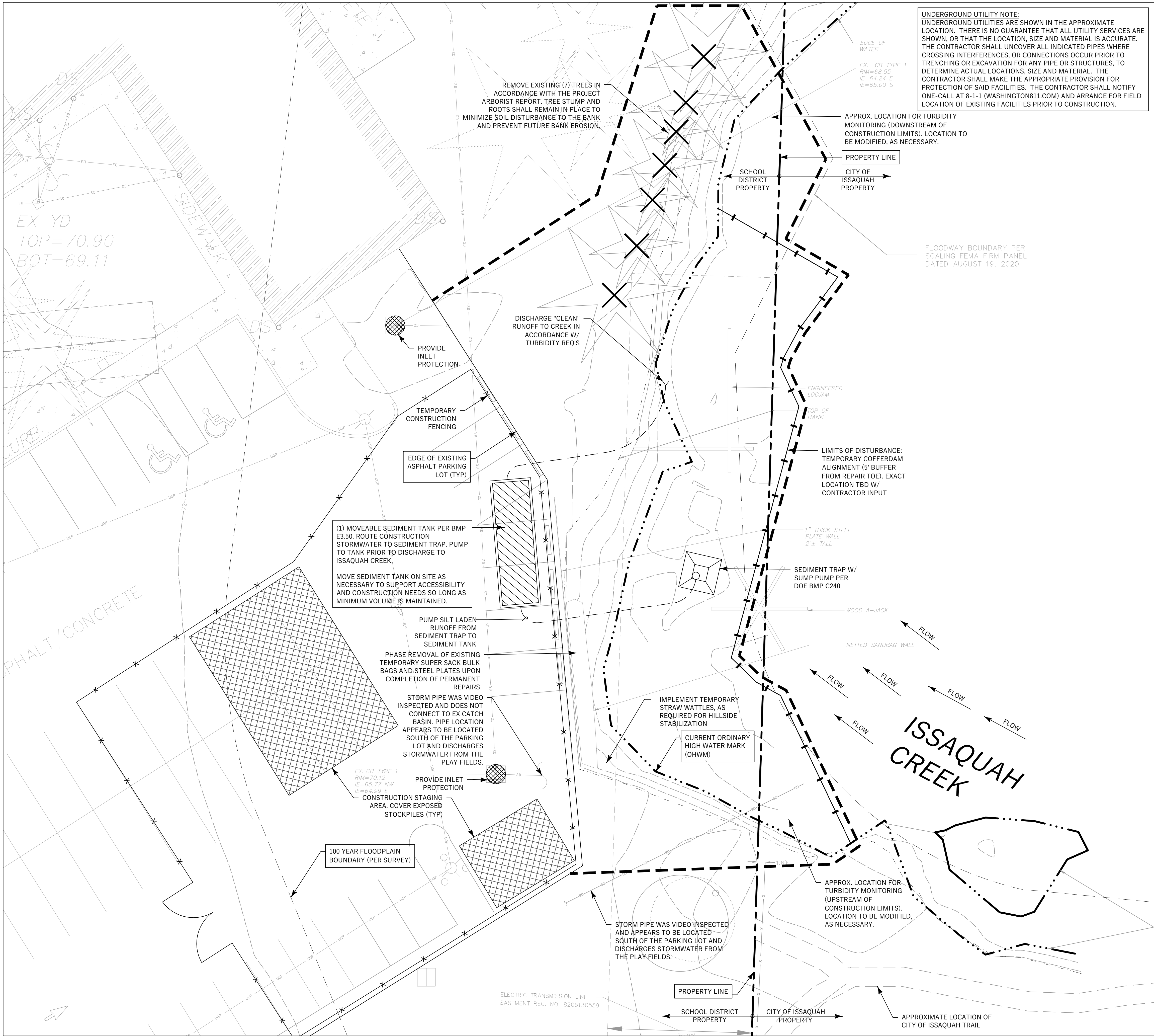
CONTACT: JANELLE WALKER
PHONE: 425.306.4022

GEOTECHNICAL ENGINEER:
NELSON GEOTECHNICAL ASSOCIATES
17311 135TH AVE. N.E. SUITE A-500
WOODINVILLE, WA 98072

CONTACT: KHAL M. SHAWISH, PE
PHONE: 425.486.1669

PROJECT: 2020-19	SHEET:
DATE: 2021.10.22	C-110
SCALE: SEE PLAN	

SPECIFICATIONS &
NOTES



LEGEND	
PROPERTY LINE	---
EXISTING CONTOUR	---268---
LIMITS OF CONSTRUCTION	- - - - -

THE ESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC FACILITIES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT-LADEN WATER DO NOT LEAVE THE SITE. ANY SUCH FACILITIES INSTALLED MUST BE MAINTAINED IN PROPER OPERATING CONDITION UNTIL ALL DISTURBED AREAS HAVE BEEN REVEGETATED OR OTHERWISE DEVELOPED AND THE POTENTIAL FOR EROSION ELIMINATED.

- GENERAL TESC NOTES:**
- THE EROSION & SEDIMENT CONTROL (ESC) MEASURES SHOWN ON THIS PLANS ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC MEASURES MUST BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND MODIFIED TO ACCOUNT FOR CHANGING SITE CONDITIONS (E.G. ADDITIONAL COVER MEASURES, PUMPING AND CONTAINMENT, RELOCATION OF DITCHES AND SILT FENCES, PERIMETER PROTECTION ETC.)
 - THESE FACILITIES MUST BE SATISFACTORILY MAINTAINED UNTIL THE CONSTRUCTION AND LANDSCAPING IS COMPLETED AND THE POTENTIAL FOR ONSITE EROSION HAS PASSED. THE ESC PLANS ARE TO BE CONSIDERED A DYNAMIC MINIMUM GUIDELINE AND AS SUCH WILL MOST LIKELY HAVE TO BE CONTINUALLY EVALUATED AND/OR MODIFIED DEPENDING ON SITE CONDITIONS.
 - THE IMPLEMENTATION OF THESE ESC PLANS AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE DEVELOPER AND ESC SUPERVISOR UNTIL ALL CONSTRUCTION IS APPROVED.
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 - THE ESC FACILITIES MUST BE INSPECTED DAILY BY THE DEVELOPER/ESC SUPERVISOR AND MAINTAINED TO ENSURE CONTINUED PROPER FUNCTIONING. WRITTEN RECORDS MUST BE KEPT OF WEEKLY REVIEWS OF THE ESC FACILITIES.
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 - DUST GENERATED DURING CONSTRUCTION ACTIVITIES MUST BE CONTROLLED BY WETTING DUST SOURCES SUCH AS AREAS OF EXPOSED SOILS, WASHING TRUCK WHEELS BEFORE THEY LEAVE THE SITE, AND INSTALLING AND MAINTAINING ROCK CONSTRUCTION ENTRANCES. CONTRACTORS MUST MECHANICALLY SWEEP STREETS DAILY WITH VACUUM SWEEPERS UNLESS OTHERWISE APPROVED.
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 - PRIOR TO SEPTEMBER 15, ALL DISTURBED AREAS SHALL BE REVIEWED TO IDENTIFY WHICH ONES CAN BE SEEDED IN PREPARATION FOR THE WINTER RAINS. DISTURBED AREAS SHALL BE SEEDED PRIOR TO OCTOBER 1.
 - REMOVE ALL ESC MEASURES ONCE ALL WORK IS COMPLETED AND SITE IS PERMANENTLY STABILIZED.

- TESC AND TURBIDITY MONITORING:**
- DISCHARGE FROM THE PROJECT SITE SHALL NOT EXCEED THE NTU LIMIT AT ALL TIMES UP TO THE 10 YEAR/24 HOUR STORM EVENT. THIS EVENT IS DEFINED AS 3/16 INCHES OF RAINFALL OVER A 24 HOUR PERIOD, AS MEASURED AT THE CITY'S RAIN GAGE. DATA FROM THIS RAIN GAGE IS POSTED ON THE CITY'S WEBSITE. THE DISCHARGE LIMIT TO A NATURAL WATER BODY IS 5 NTU OVER BACKGROUND, OTHERWISE THE LIMIT SHALL BE 100 NTU. EXCEEDANCE OF THE NTU LIMIT IS CONSIDERED A VIOLATION OF THE PERMIT AND IS SUBJECT TO STOP WORK AND CODE VIOLATION PENALTIES.
 - THE CITY OF ISSAQUAH WILL MEASURE THE TURBIDITY OF ANY DISCHARGE AT THE DESIGNATED MONITORING POINTS TO VERIFY COMPLIANCE WITH THE DISCHARGE LIMIT. THE TESC SUPERVISOR SHALL BE NOTIFIED OF DISCHARGES ABOVE 25 NTUS, SO THAT ACTION CAN BE TAKEN TO KEEP DISCHARGES BELOW THESE THRESHOLD LEVELS. FOR PROJECT SITES WHERE DESIGNATING A MONITORING POINT IS NOT FEASIBLE (E.G. FLAT SITES), THE MONITORING LOCATIONS WILL BE AT THE DISCRETION OF THE CITY OF ISSAQUAH.
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 - FAILURE TO PROVIDE AND MAINTAIN APPROVED TESC FACILITIES AT CONSTRUCTION SITES IS CONSIDERED A VIOLATION OF THE PERMIT AND IS SUBJECT TO STOP WORK AND CODE VIOLATION PENALTIES.
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PERMANENT CREEK REPAIR
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ISSAQUAH, WA 98027

NO.	REVISION / ISSUE	DATE

OWNER:
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5150 220TH AVE SE
ISSAQUAH, WA 98029

CONTACT: JANELLE WALKER
PHONE: 425.306.4022

GEOTECHNICAL ENGINEER:
NELSON GEOTECHNICAL ASSOCIATES
17311 135TH AVE. N.E. SUITE A-500
WOODINVILLE, WA 98072

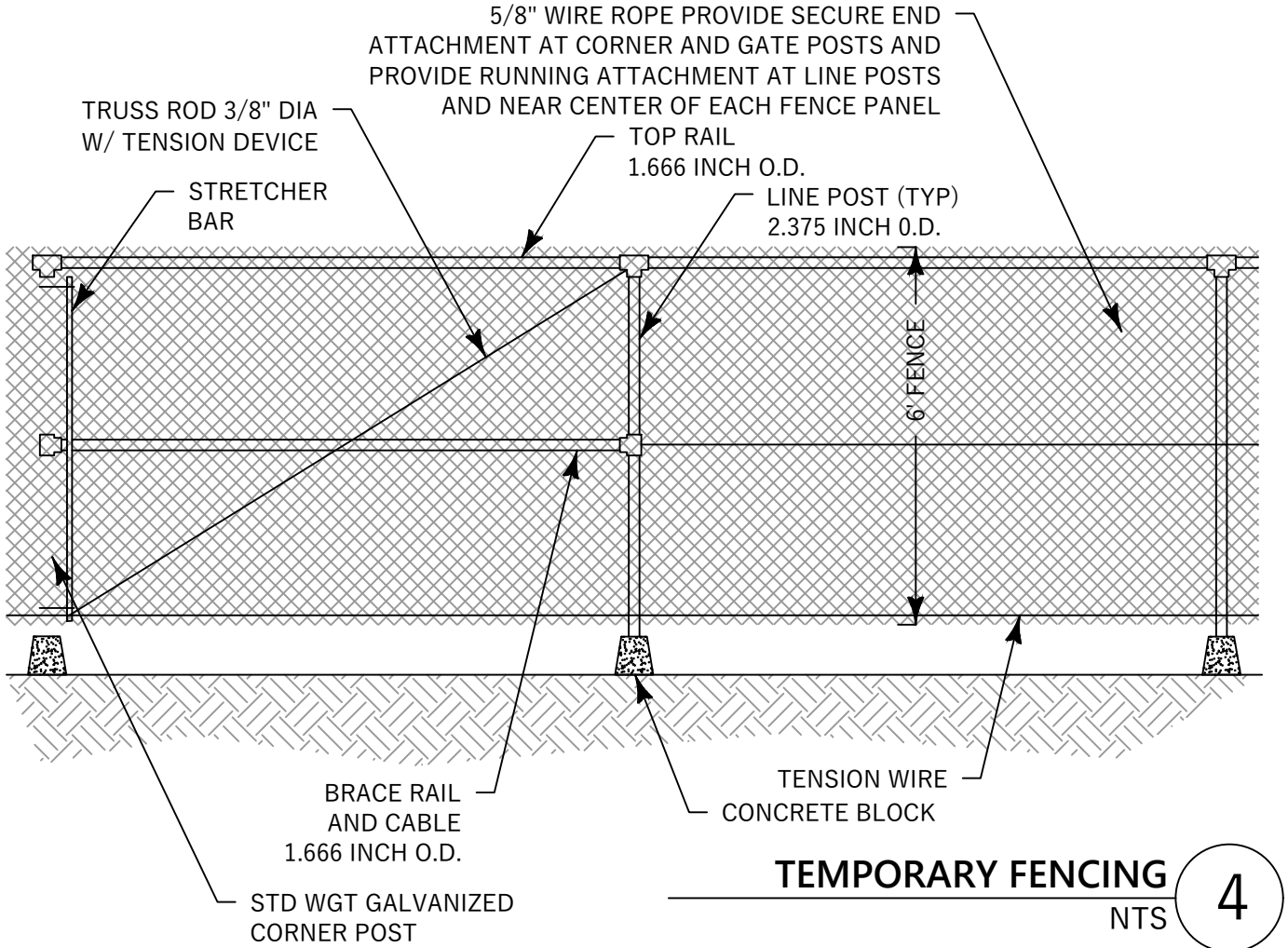
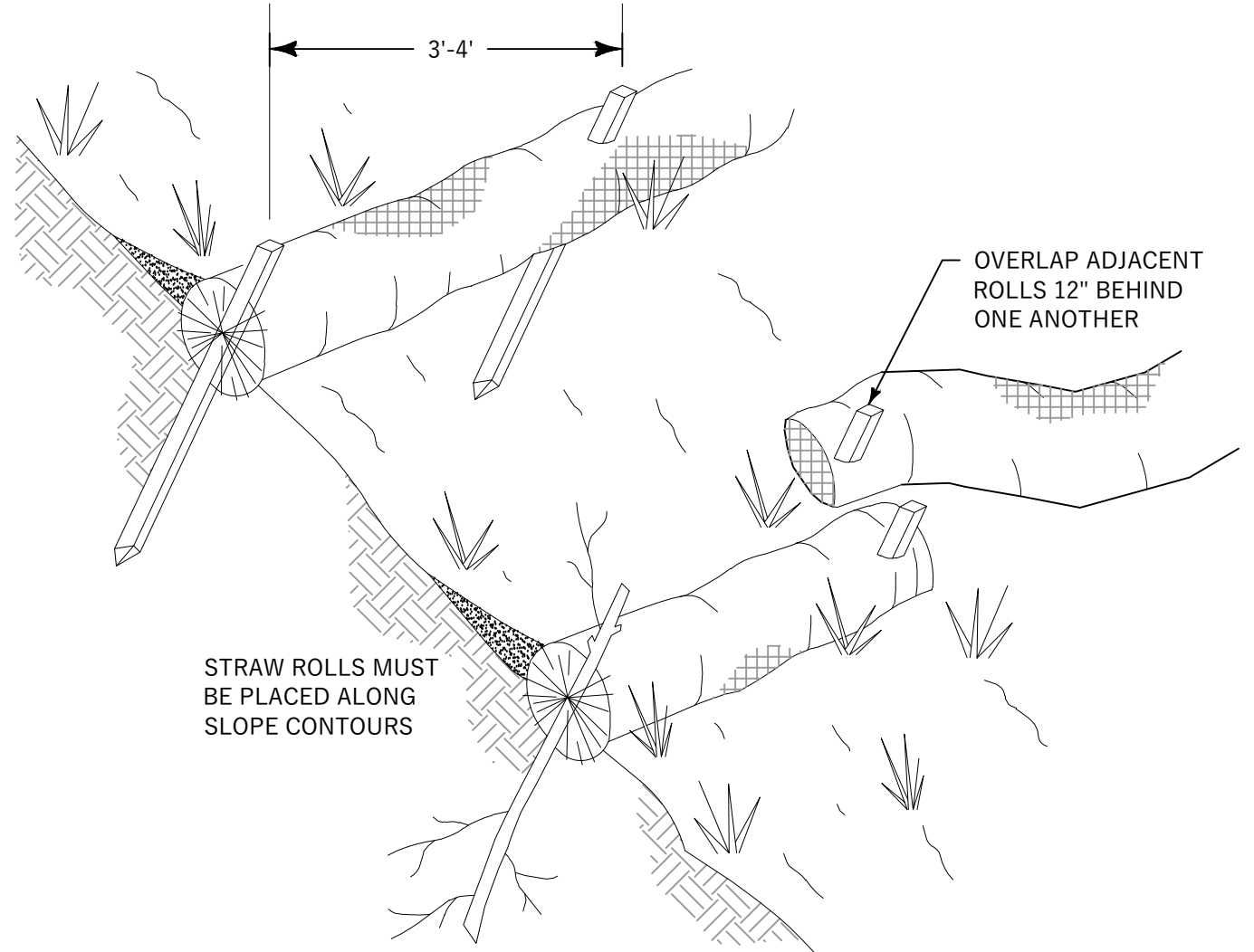
CONTACT: KHAL M. SHAWISH, PE
PHONE: 425.486.1669

PROJECT: 2020-19	SHEET:
DATE: 2021.10.22	C-200
SCALE: SEE PLAN	

TEMPORARY EROSION AND
SEDIMENT CONTROL PLAN

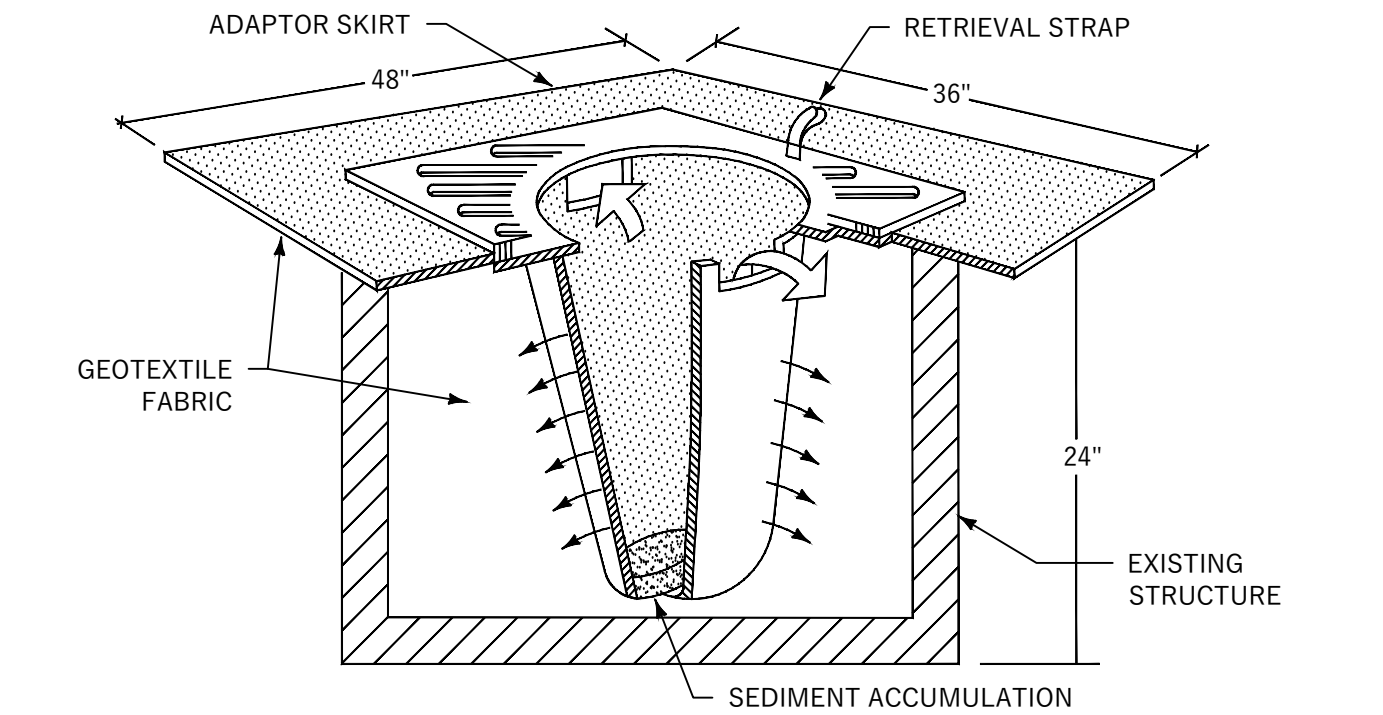
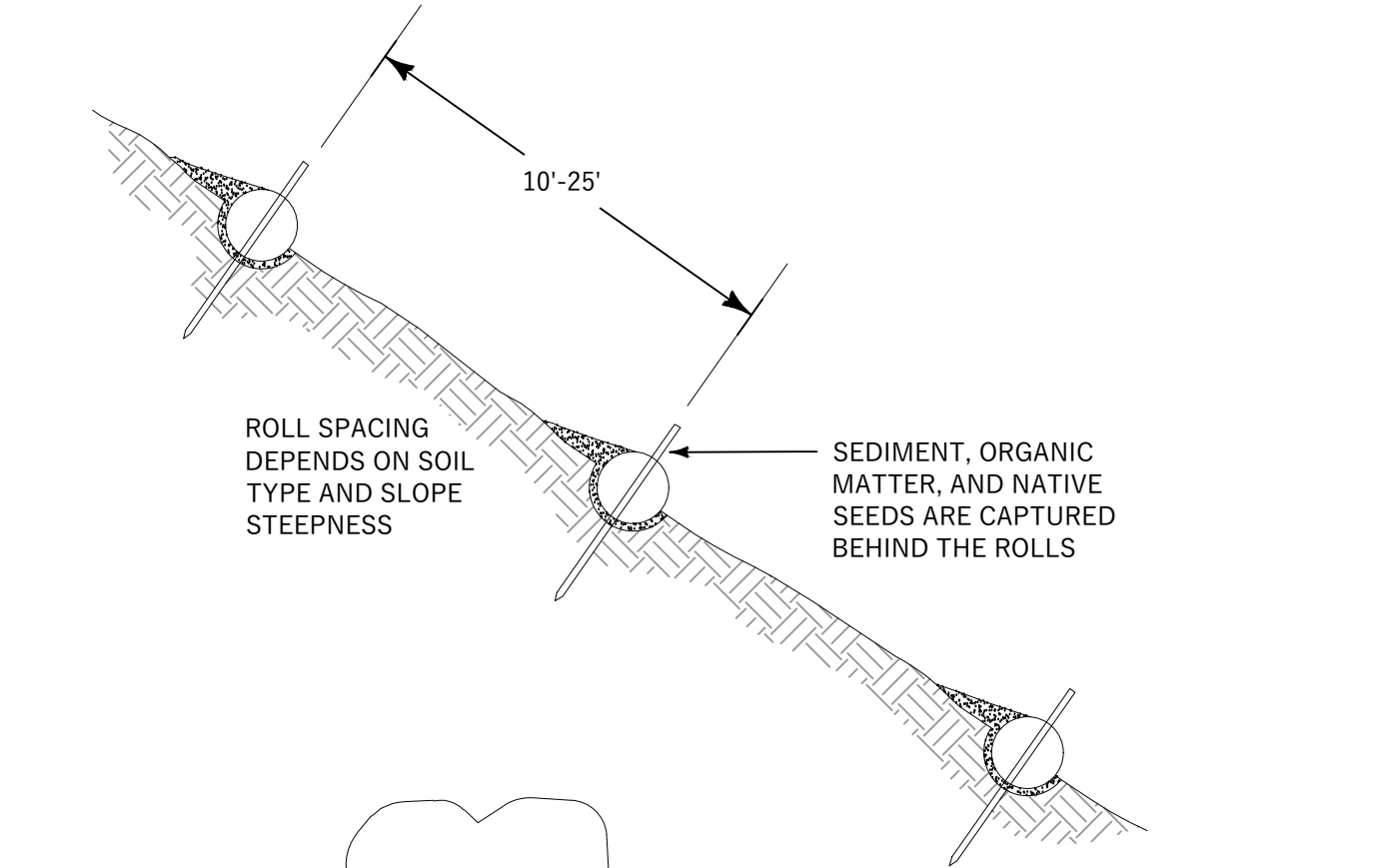
NOT USED
NTS 1

NOT USED
NTS 2



NOT USED
NTS 5

NOT USED
NTS 6

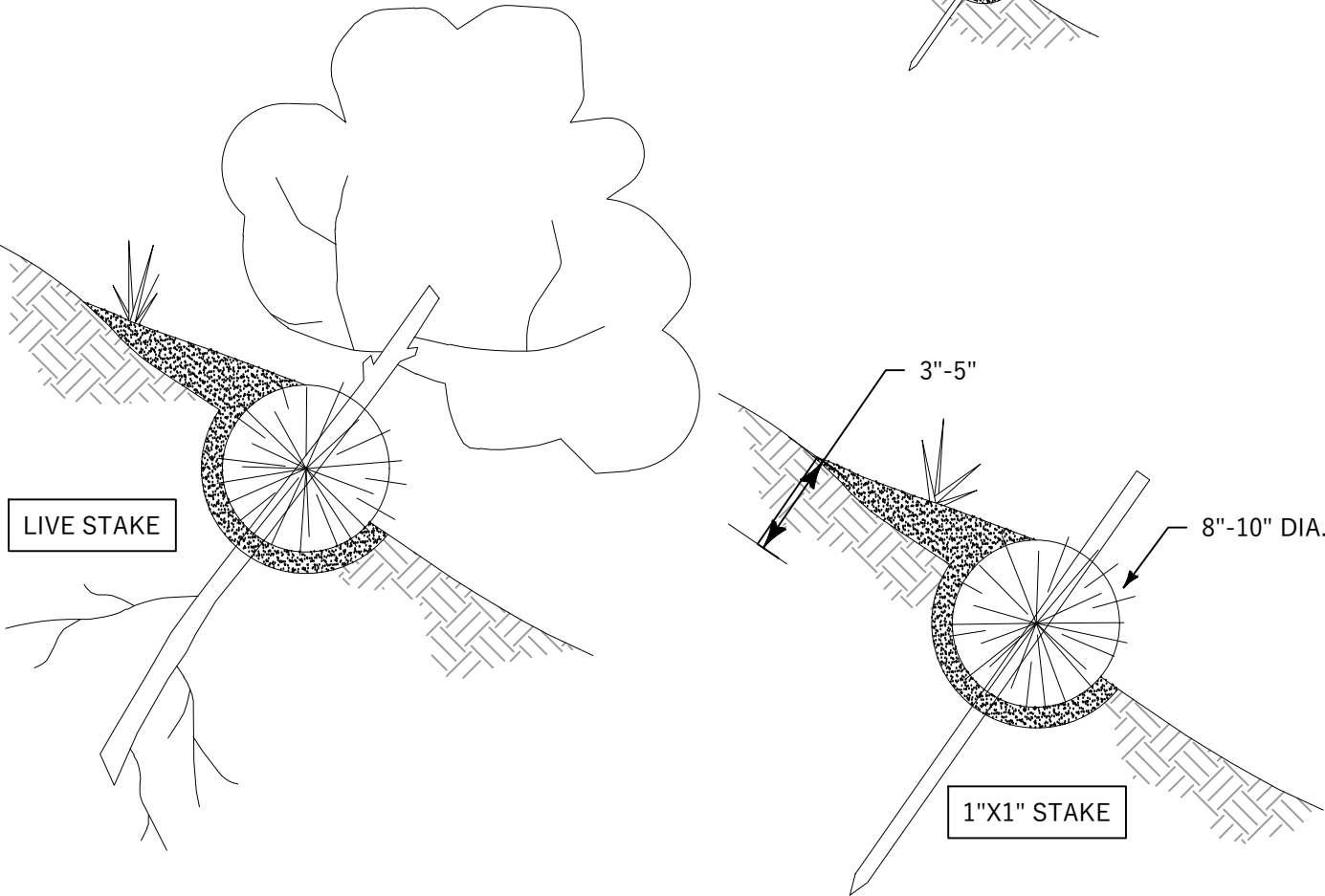


NOTES:
1. FILTERS SHALL BE INSPECTED AFTER EACH STORM EVENT AND CLEANED OR REPLACED WHEN 1/3 FULL.
2. INSTALL INLET PROECTION IN ALL NEW STORM STRUCTURES THAT WILL COLLECT STORMWATER AS THEY ARE INSTALLED.

INLET PROTECTION
NTS 8

NOT USED
NTS 9

NOT USED
NTS 10



NOTES:
1. FILTERS STRAW ROLL INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 3" X 5" (75-125MM) DEEP, DUG ON CONTOUR.
2. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.

STRAW WATTLE
NTS 11

NOT USED
NTS 12

NOT USED
NTS 13

NOT USED
NTS 14

NOT USED
NTS 15

NOT USED
NTS 16



ISD HOLLY STREET CAMPUS
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ISSAQUAH, WA 98029

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NELSON GEOTECHNICAL ASSOCIATES
17311 135TH AVE. N.E. SUITE A-500
WOODINVILLE, WA 98072


CONTACT: KHAL M. SHAWISH, PE
PHONE: 425.486.1669

PROJECT: 2020-19	SHEET:
DATE: 2021.10.22	C-210
SCALE: SEE PLAN	


T.E.S.C DETAILS



UNDERGROUND UTILITY NOTE:
UNDERGROUND UTILITIES ARE SHOWN IN THE APPROXIMATE LOCATION. THERE IS NO GUARANTEE THAT ALL UTILITY SERVICES ARE SHOWN, OR THAT THE LOCATION, SIZE AND MATERIAL IS ACCURATE. THE CONTRACTOR SHALL UNCOVER ALL INDICATED PIPES WHERE CROSSING INTERFERENCES, OR CONNECTIONS OCCUR PRIOR TO TRENCHING OR EXCAVATION FOR ANY PIPE OR STRUCTURES, TO DETERMINE ACTUAL LOCATIONS, SIZE AND MATERIAL. THE CONTRACTOR SHALL MAKE THE APPROPRIATE PROVISION FOR PROTECTION OF SAID FACILITIES. THE CONTRACTOR SHALL NOTIFY ONE-CALL AT 8-1-1 (WASHINGTON811.COM) AND ARRANGE FOR FIELD LOCATION OF EXISTING FACILITIES PRIOR TO CONSTRUCTION.




Call
before you
Dig.
8-1-1 or
1-800-424-5555
UNDERGROUND SERVICE (USA)




0 20 40 Feet

SCALE 1"=10'

LEGEND

PROPERTY LINE 

EXISTING CONTOUR  268

THE ESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC MEASURES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT-LADEN WATER DO NOT LEAVE THE SITE. ANY SUCH FACILITIES INSTALLED MUST BE MAINTAINED IN PROPER OPERATING CONDITION UNTIL ALL DISTURBED AREAS HAVE BEEN REVEGETATED OR OTHERWISE DEVELOPED AND THE POTENTIAL FOR EROSION ELIMINATED.

- GENERAL TESC NOTES:
- THE EROSION & SEDIMENT CONTROL (ESC) MEASURES SHOWN ON THIS PLANS ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC MEASURES MUST BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND MODIFIED TO ACCOUNT FOR CHANGING SITE CONDITIONS (E.G. ADDITIONAL COVER MEASURES, PUMPING AND CONTAINMENT, RELOCATION OF DITCHES AND SILT FENCES, PERIMETER PROTECTION ETC.)
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565 NW HOLLY STREET
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NO.	REVISION / ISSUE	DATE

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5150 220TH AVE SE
ISSAQUAH, WA 98029

CONTACT: JANELLE WALKER
PHONE: 425.306.4022

GEOTECHNICAL ENGINEER:
NELSON GEOTECHNICAL ASSOCIATES
17311 135TH AVE. N.E. SUITE A-500
WOODINVILLE, WA 98072

CONTACT: KHAL M. SHAWISH, PE
PHONE: 425.486.1669

PROJECT: 2020-19	SHEET:
DATE: 2021.10.22	C-300
SCALE: SEE PLAN	

CONSTRUCTION SITE PLAN

NOT USED
NTS 1

NOT USED
NTS 2

NOT USED
NTS 5

NOT USED
NTS 6

NOT USED
NTS 9

NOT USED
NTS 10

NOT USED
NTS 11

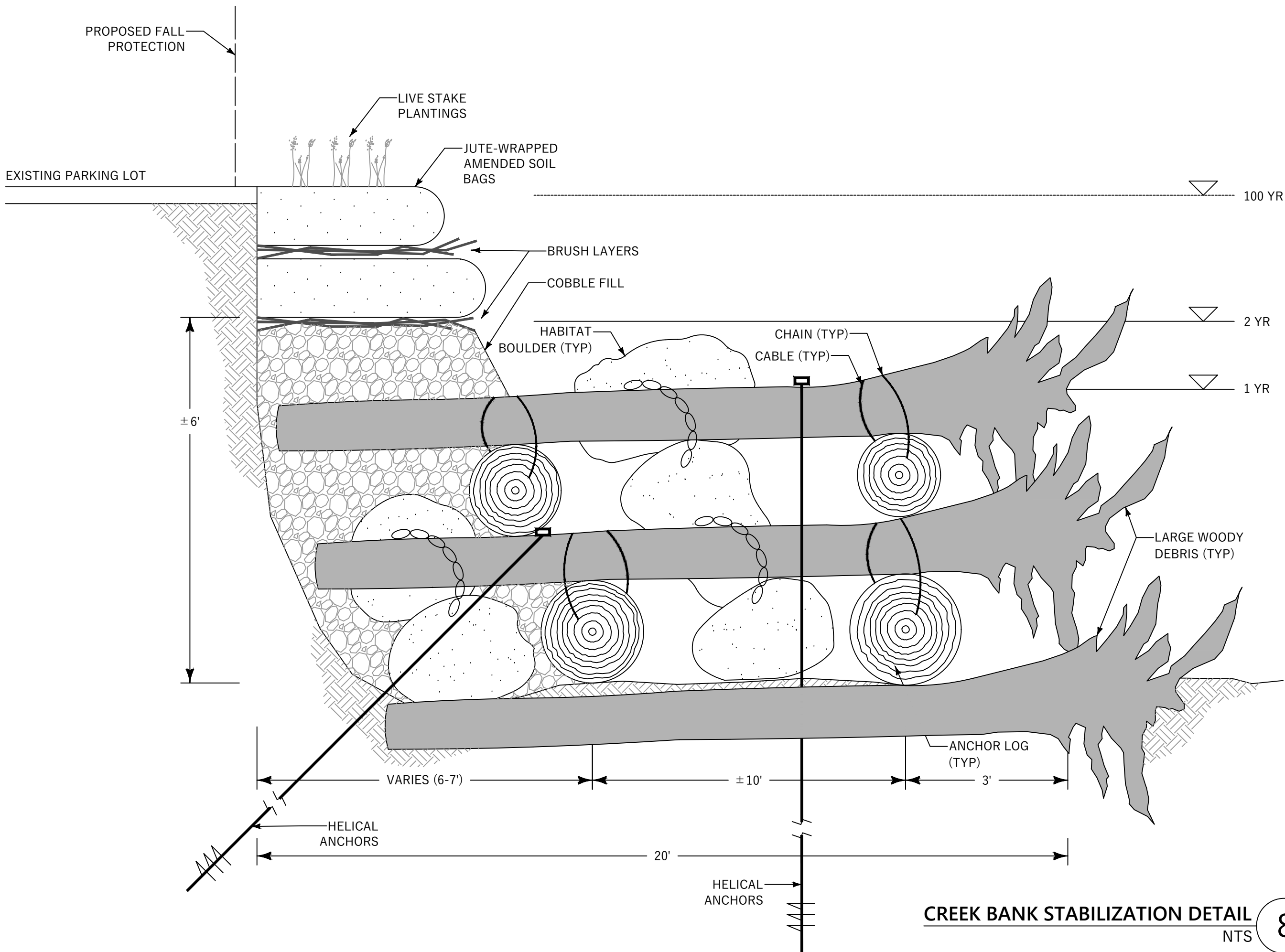
NOT USED
NTS 12

NOT USED
NTS 13

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NTS 14

NOT USED
NTS 15

NOT USED
NTS 16



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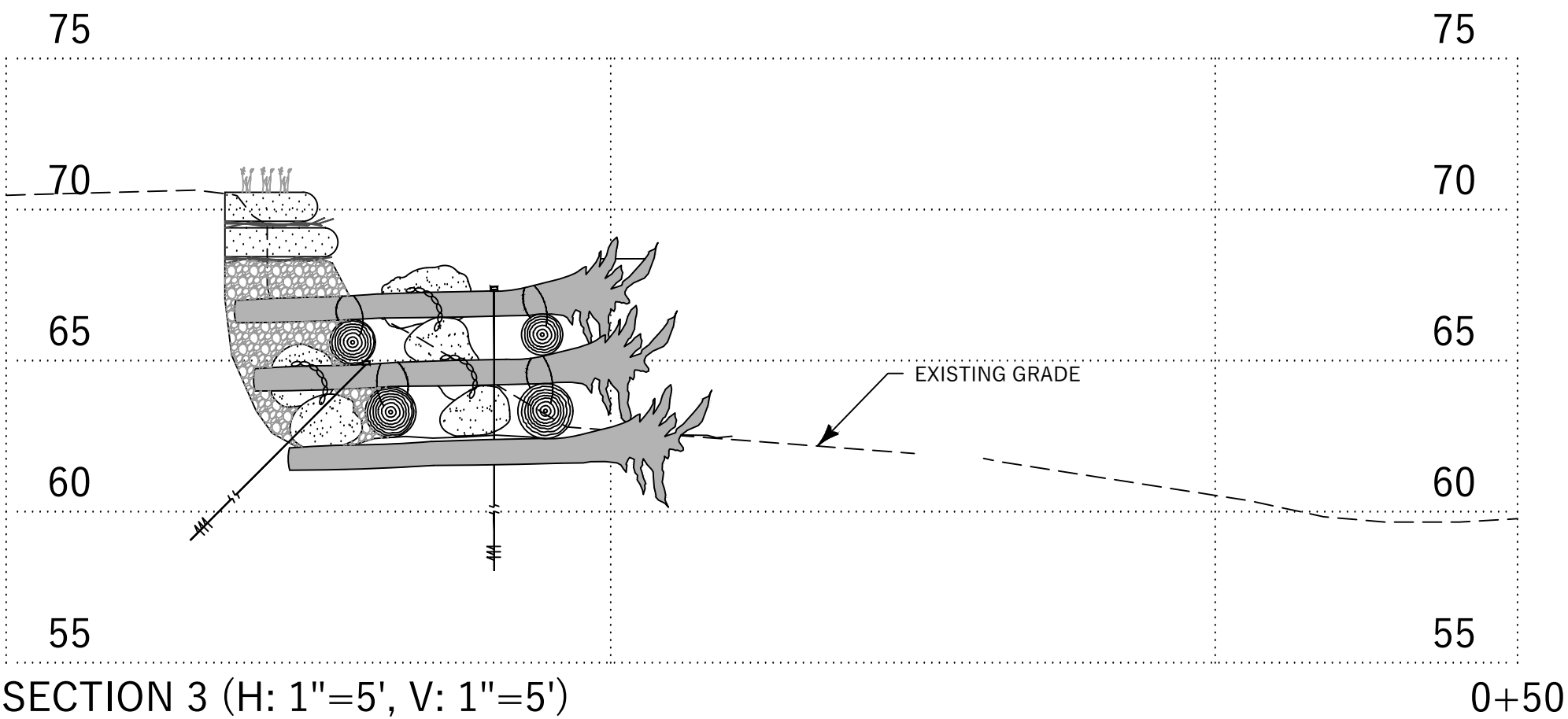
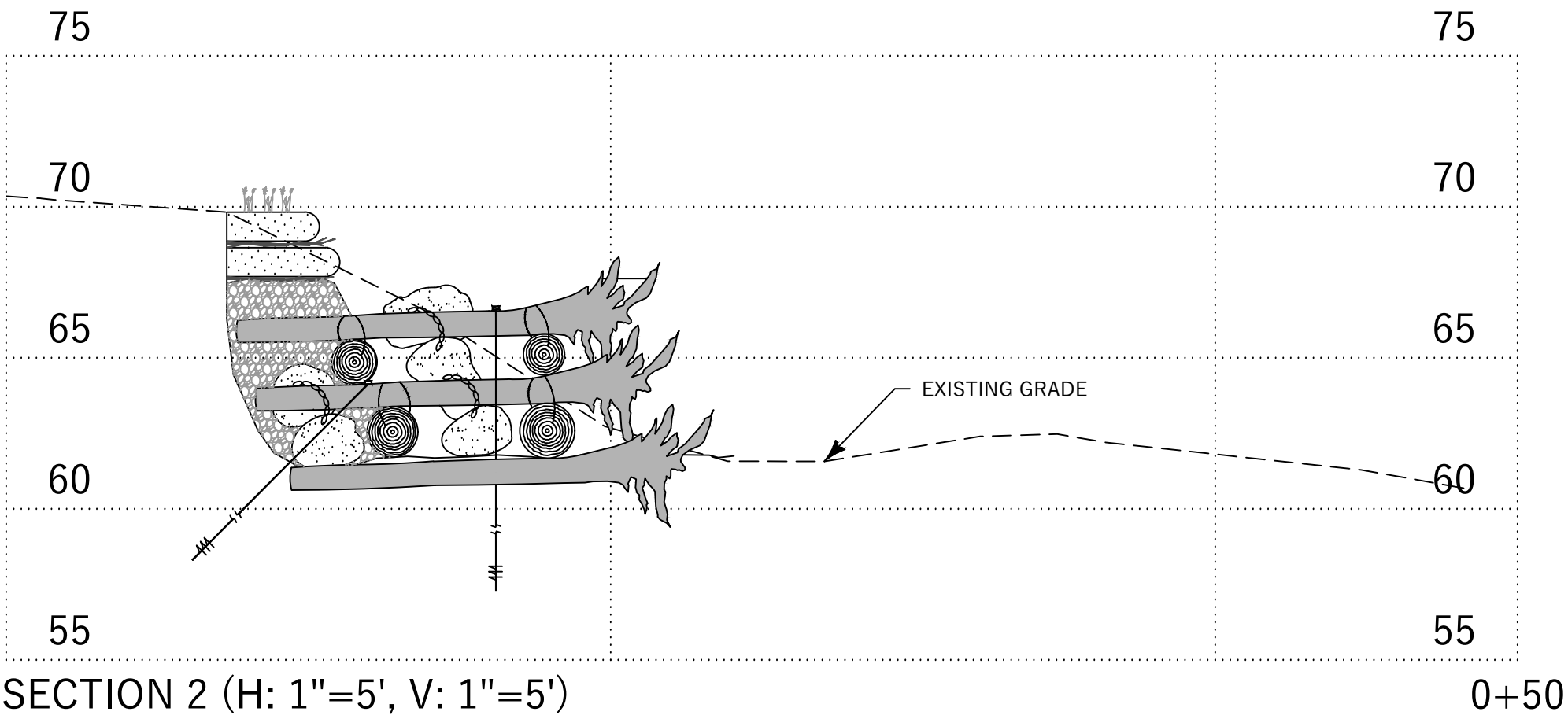
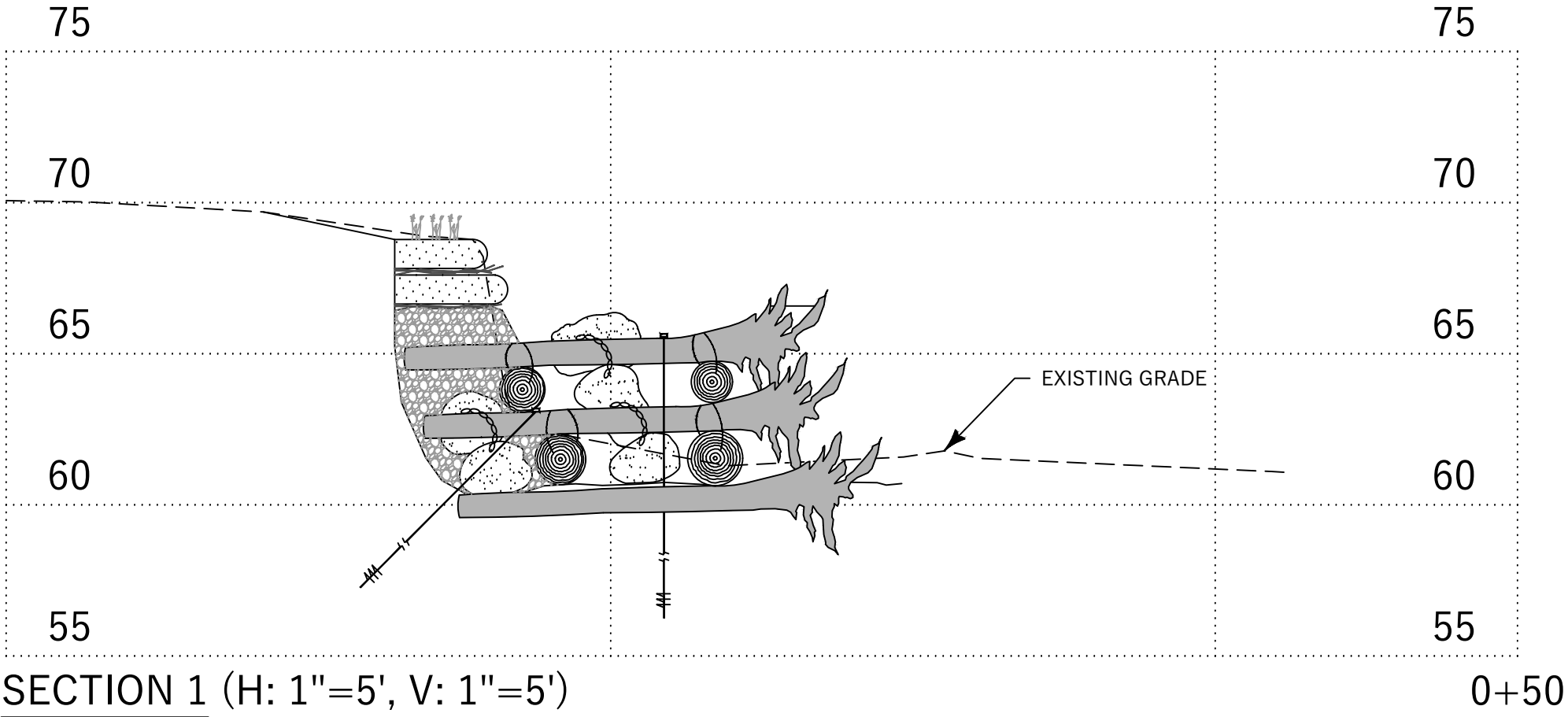
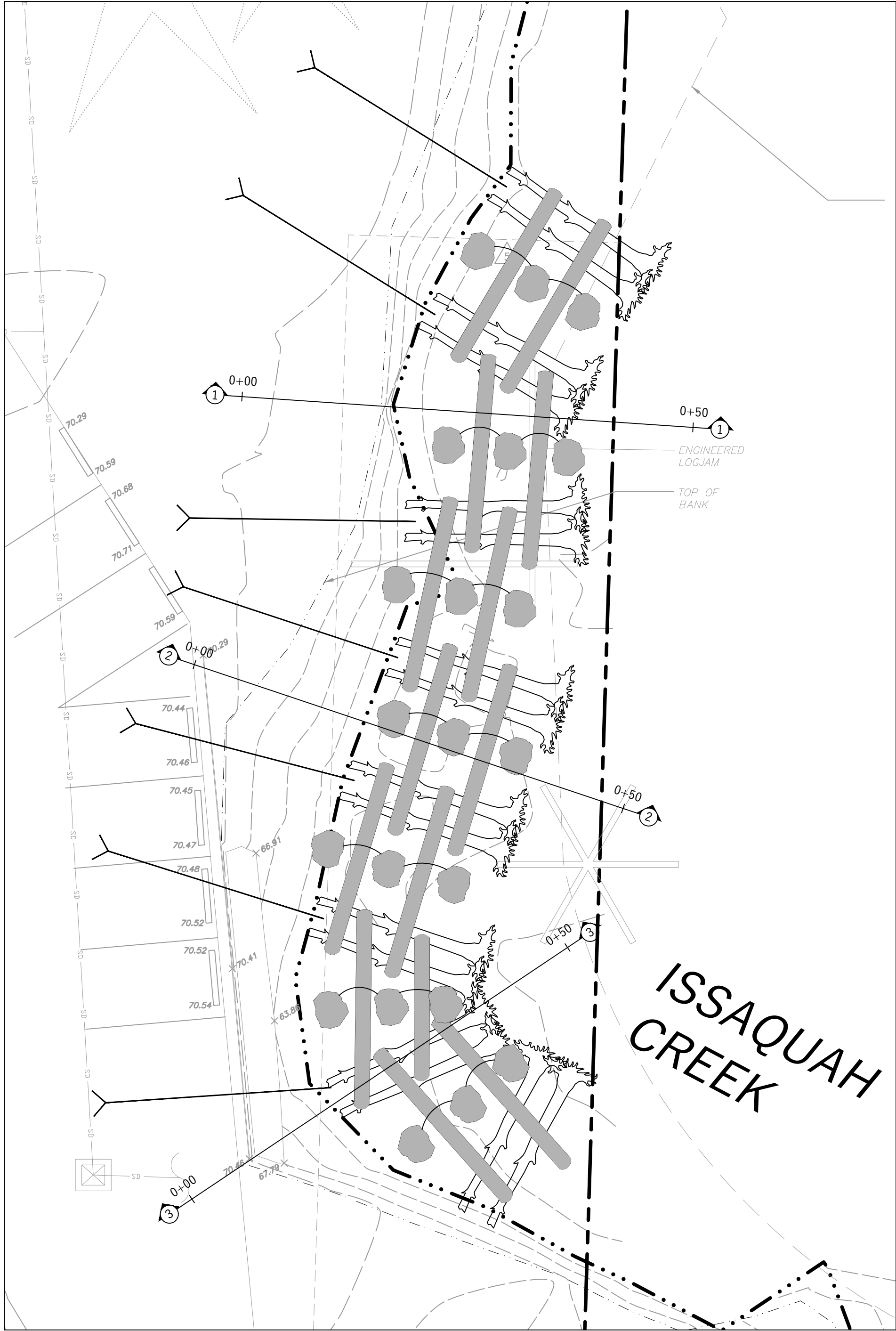
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CONTACT: KHAL M. SHAWISH, PE
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PROJECT: 2020-19	SHEET:
DATE: 2021.10.22	C-310
SCALE: SEE PLAN	

CONSTRUCTION
DETAILS

SITE PLAN (SCALE: 1"=10')



ISS HOLLY STREET CAMPUS
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565 NW HOLLY STREET
ISSAQUAH, WA 98027

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PROJECT: 2020-19	SHEET:
DATE: 2021.10.22	C-311
SCALE: SEE PLAN	

STREAM
SECTIONS

APPENDIX I

TESC Report and SWPPP

Temporary Erosion and Sediment Control (TESC) Report and Stormwater Pollution Prevention Plan For Construction Activities

Type of Project: Commercial/Plat

Project Information

Project Name: ISD Holly Street Campus - Permanent Creek Repair

Project Address/Site Location: 565 NW Holly Street, Issaquah, WA 98027

Permit Number: _____

Owner/Developer: Issaquah School District 411

General Contractor: TBD

Site Contractor: TBD

Certified Erosion and Sediment Control Lead (CESCL): TBD

Prepared by: Chasen Simpson, PE (Latitude 48 Engineers)

Date Prepared: 10/22/2021

Site Information

Property Area (sq ft/acres): 19.31 Acres

Area to be Cleared and Graded (sq ft/acres): +/- 8,900 SF

Estimated Total Fill (cu yds): 780 CY

Estimated Total Excavation (cu yds): 450 CY

Existing Impervious Area (sq ft/acres): 0 SF

New Impervious Area (sq ft/acres): 0 SF

Replaced Impervious Area (sq ft/acres): 0 SF

1. INTRODUCTION

This Temporary Erosion and Sediment Control Report and Stormwater Pollution Prevention Plan for the City of Issaquah (TESC Report) has been prepared as part of the City of Issaquah Permit for the ISD Permanent Creek Repairs construction project.

The Contractor is required to comply with the terms of this TESC Report and the TESC measures shown on the approved permit plans. The Contractor's TESC Supervisor shall be responsible for the performance, maintenance, and review of TESC measures as described in this TESC Report and the approved plans. With the exception of small projects, the TESC supervisor shall be a Certified Erosion and Sediment Control Lead (CESCL).

TESC measures shall be in accordance with the City of Issaquah are described in the 2017 City of Issaquah Stormwater Design Manual Addendum to the 2014 Stormwater Management Manual for Western Washington. This document is available at <http://issaquahwa.gov/DocumentCenter/View/1049>.

2. SITE DESCRIPTION

Briefly describe below the existing conditions, topography, soils, etc, as appropriate.

The site occurs within Issaquah Creek along the west creek bank approximately 8 feet below the existing asphalt parking lot. See accompanying temporary erosion and sediment control plan.

3. PROPOSED CONSTRUCTION ACTIVITIES AND APPROXIMATE SCHEDULE

Briefly describe below the proposed construction activities for the project. Describe or include as an attachment a schedule for the project activities. Typical activities include utility installation, building foundations, frontage improvements, paving, etc.

The project includes permanent stabilization of the creek bank using a series of large woody debris anchored to the creek bank.

4. CONSTRUCTION TESC BEST MANAGEMENT PRACTICES (BMPS)

Describe below how each of the following BMPs apply to the project. These BMPs are to be shown on the project plans as appropriate. Address the different phases of construction (e.g. clearing and grading, utility installation, building construction).

a. Monitoring Points

Identify Monitoring Points on the TESC plans for all locations where runoff discharges from the project site for all phases of construction. The City will measure the turbidity of the discharge at the Monitoring Points to verify compliance with the permit. Identify any temporary discharge points during construction and also the discharge points for all permanent storm drainage systems.

Description of Monitoring Points: Monitor the downstream end of the creek, where the sediment tank discharges water back into the creek.

b. Clearing Limits

Describe the clearing and grading limits for the project. The purpose of the clearing limits is to define the project boundaries and to prevent disturbance of areas not designated for clearing and grading (e.g. critical areas and buffers).

Description of Clearing Limits:

Clearing will occur along the creek bank, where necessary for installation of the woody debris an associated anchoring.

c. Cover Measures

Describe the temporary cover measures (e.g. straw or other mulch, erosion control blankets, plastic, etc) that will be used to protect disturbed areas. Providing cover measures for as much disturbed area as possible is the most practical way to reduce turbidity in runoff.

Description of Cover Measures:

See temporary erosion and sediment control plan.

d. Perimeter Protection

Describe how and where perimeter protection (e.g. silt fence, straw/compost wattles) to filter sediment from sheet flow shall be provided downstream of all disturbed areas. Perimeter protection shall be provided to protect any critical areas and buffers.

Description of Perimeter Protection:

A temporary cofferdam will be installed (5' from the repair toe) which will establish the perimeter of the improvements within the creek. Straw wattles will be used to stabilize the exposed soils within the limits of disturbance.

e. Traffic Area Stabilization (including Truck Wheel Wash Areas)

Describe the locations and BMPs to be used to stabilize unsurfaced entrances, roads, and parking areas used by construction traffic to minimize erosion and tracking of sediment offsite. Alternative measures such as a wheel wash shall be used if traffic area stabilization does not prevent sediment from being tracked offsite.

Description of Traffic Area Stabilization (including Truck Wheel Wash Areas):

Straw mulch will be used to protect disturbed areas and any stockpiled material will be covered with plastic.

f. Sediment Retention

Describe any temporary sediment ponds/traps, tanks, or other storage methods that will be used to treat surface water collected from disturbed areas prior to discharge from the site. Also describe how storm drain inlet protection measures (e.g. silt socks) will be used for the project.

Description of Sediment Retention Measures:

A temporary sediment trap will be used to collect silt laden runoff. A sediment tank will be used to treat surface water prior to releasing back into the creek.

g. Surface Water Collection

Describe the surface water collection measures (e.g. ditches, berms, etc.) that will be used to intercept and direct surface water from disturbed areas to sediment ponds/traps, tanks, or other storage methods. This includes any diversions needed to address drainage uphill from the project site.

Description of Surface Water Collection Measures:

A temporary sediment trap will be located at the low-point behind the temporary cofferdam.

h. Dewatering Control

Describe the BMPs to be used to manage turbid water resulting from the dewatering of utilities, excavations, foundations, etc. Water shall not be pumped offsite without prior approval from the City inspector.

Description of Dewatering Control Measures:

Any dewatering of the site will be directed to a settling pond to allow any turbid water to clear.

i. Dust Control

Preventive measures shall be used as needed to minimize wind-borne dust from leaving the project site. Water used for dust control shall be minimized so that it does not generate runoff.

Description of Dust Control Measures:

Preventative measures to minimize wind transport of soil shall be implemented when a traffic hazard may be created or when sediment transported by wind is likely to be deposited in water resources.

j. Flow Control

Provisions shall be made to prevent increases in the existing site conditions 2-year and 10-year runoff peaks discharging from the site during construction.

Description of Flow Control Measures:

The sediment tank can be used to store surface runoff to prevent increases in the existing site conditions 2-year and 10-year runoff peaks discharging from the site during construction.

k. Final Site Stabilization

Describe how disturbed areas will be stabilized at the completion of the project (e.g. permanent landscaping, straw or other mulch, hydroseed, etc.)

Description of Final Site Stabilization Measures:

The site will be fully landscaped with woody debris, brush layers, habitat boulders, jute-wrapped amended soil bags, and live stake plantings.

5. WET SEASON REQUIREMENTS

If construction is scheduled during the wet season (October 1st to April 30), describe any additional BMPs that may be used to meet wet season requirements. If the wet season BMPs can be addressed in these plans and TESC Report, an updated plan and TESC Report will not be required for construction during the wet season.

6. POLLUTION PREVENTION AND SPILL PREVENTION BMPS

Describe the BMPs to be used for each of the following activities:

a. Storage and Handling of Hazardous Materials

Hazardous materials include petroleum products such as oil, fuel, cold mix, paint, solvents, curing compounds, etc. Liquid products stored outside that may contaminate stormwater runoff if spilled shall be stored under cover and in containment. Describe the BMPs for storage and handling of hazardous materials.

Hazardous materials are not anticipated for this project.

b. Concrete Work and Paving Operations

Describe the BMPs to be used to ensure materials used during concrete work and paving operations do not enter storm drainage systems, surface waters, or wetlands.

Concrete work and paving operations is not anticipated for this project.

c. Spill Kits and Spill Response

Describe the spill control plan for the construction project.

Contaminated surfaces will be cleaned immediately following any discharge or spill incident. Spills will be reported within 24 hours. Emergency repairs may be performed on-site using temporary plastic placed beneath and, if raining, over the vehicle.

7. DEVELOPER/CONTRACTOR SITE INSPECTIONS AND RECORDKEEPING

Describe the TESC site inspections and recordkeeping that will be performed by the developer/contractor for the project:

A site log book will be maintained for all on-site construction activities and will include: a record of the implementation of the SWPPP and other permit requirements, site inspections, and sample logs.

8. CONTACTS

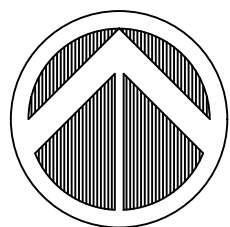
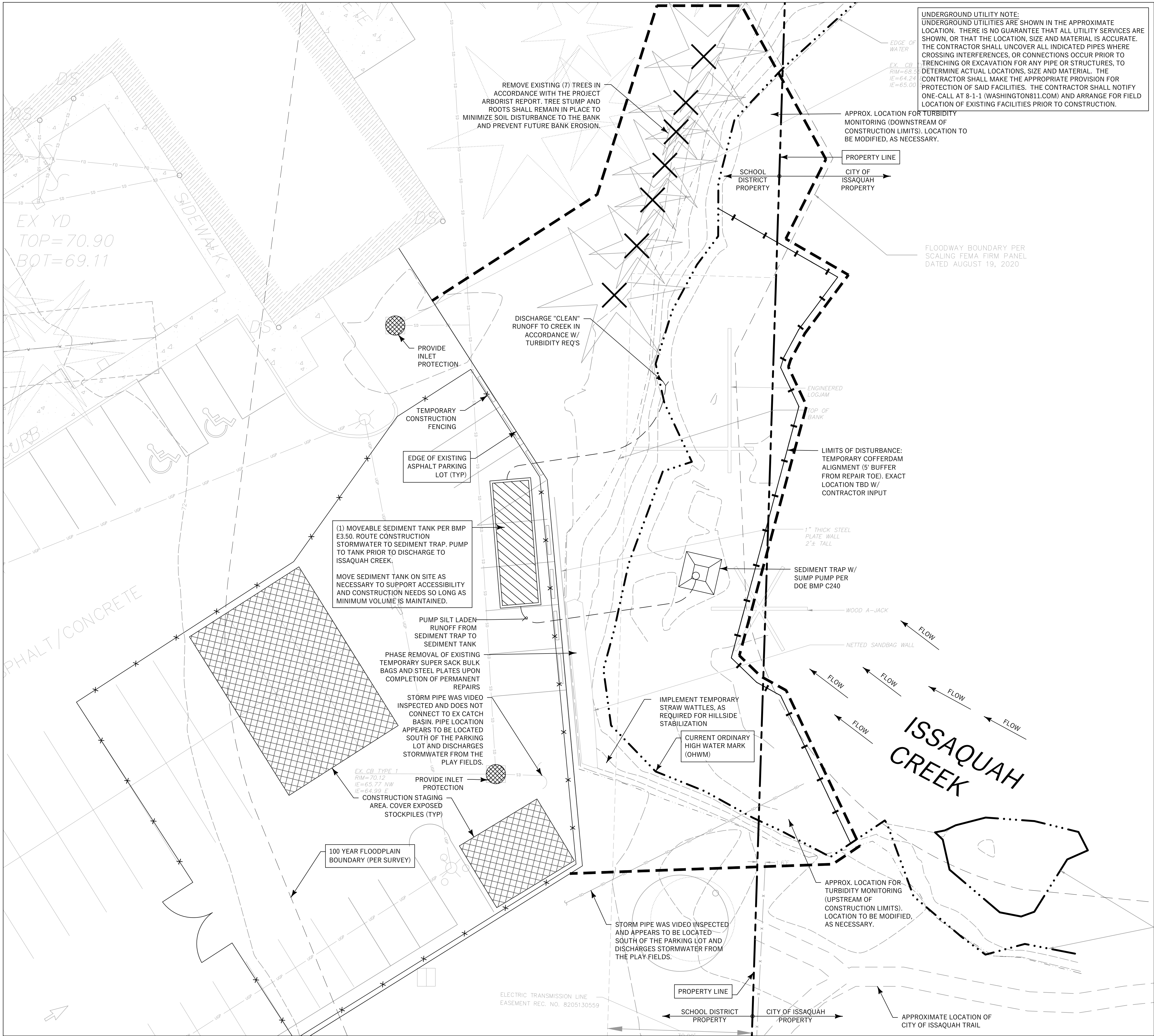
Provide contact information (name and phone numbers) for the following:

Owner/developer: Issaquah School District 411

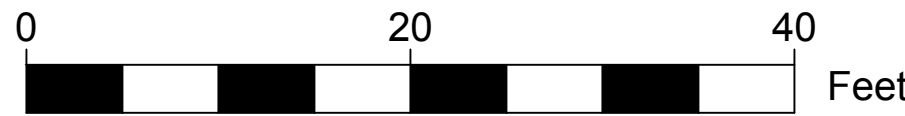
General Contractor: TBD

Site Contractor: TBD

Certified Erosion and Sediment Control Lead (CESCL): TBD



Call
before you
Dig.
8-1-1 or
1-800-424-5555
UNDERGROUND SERVICE (USA)



SCALE 1"=10'

LEGEND

PROPERTY LINE	
EXISTING CONTOUR	
LIMITS OF CONSTRUCTION	

THE ESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC MEASURES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT-LADEN WATER DO NOT LEAVE THE SITE. ANY SUCH FACILITIES INSTALLED MUST BE MAINTAINED IN PROPER OPERATING CONDITION UNTIL ALL DISTURBED AREAS HAVE BEEN REVEGETATED OR OTHERWISE DEVELOPED AND THE POTENTIAL FOR EROSION ELIMINATED.

GENERAL TESC NOTES:

- THE EROSION & SEDIMENT CONTROL (ESC) MEASURES SHOWN ON THIS PLANS ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC MEASURES MUST BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND MODIFIED TO ACCOUNT FOR CHANGING SITE CONDITIONS (E.G. ADDITIONAL COVER MEASURES, PUMPING AND CONTAINMENT, RELOCATION OF DITCHES AND SILT FENCES, PERIMETER PROTECTION ETC.)
- THESE FACILITIES MUST BE SATISFACTORILY MAINTAINED UNTIL THE CONSTRUCTION AND LANDSCAPING IS COMPLETED AND THE POTENTIAL FOR ONSITE EROSION HAS PASSED. THE ESC PLANS ARE TO BE CONSIDERED A DYNAMIC MINIMUM GUIDELINE AND AS SUCH WILL MOST LIKELY HAVE TO BE CONTINUALLY EVALUATED AND/OR MODIFIED DEPENDING ON SITE CONDITIONS.
- THE IMPLEMENTATION OF THESE ESC PLANS AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE DEVELOPER AND ESC SUPERVISOR UNTIL ALL CONSTRUCTION IS APPROVED.
- STABILIZED CONSTRUCTION ENTRANCES MUST BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES, SUCH AS CONSTRUCTED WHEEL WASH SYSTEMS OR WASH PADS, MAY BE REQUIRED TO ENSURE THAT ALL PAVED AREAS ARE KEPT CLEAN AND TRACK OUT TO ROAD RIGHT OF WAY DOES NOT OCCUR FOR THE DURATION OF THE PROJECT.
- THE ESC FACILITIES SHOWN ON THIS PLAN MUST BE CONSTRUCTED PRIOR TO OR IN CONJUNCTION WITH ALL CLEARING AND GRADING SO AS TO ENSURE THAT THE TRANSPORT OF SEDIMENT TO SURFACE WATERS, DRAINAGE SYSTEMS, AND ADJACENT PROPERTIES IS MINIMIZED.
- THE ESC FACILITIES MUST BE INSPECTED DAILY BY THE DEVELOPER/ESC SUPERVISOR AND MAINTAINED TO ENSURE CONTINUED PROPER FUNCTIONING. WRITTEN RECORDS MUST BE KEPT OF WEEKLY REVIEWS OF THE ESC FACILITIES.
- SOILS MUST NOT REMAIN EXPOSED AND UNWORKED FOR MORE THAN 7 DAYS FROM MAY 1 THROUGH SEPTEMBER 30 AND NOT MORE THAN 48 HOURS FROM OCTOBER 1 AND APRIL 30. EXPOSED AND UNWORKED SOILS MUST BE COVERED BY MULCH, SODDING, PLASTIC COVERING, LUTE-MATting, OR AS OTHERWISE APPROVED OR REQUIRED BY THE PUBLIC WORKS CONSTRUCTION INSPECTOR.
- THE ESC FACILITIES ON INACTIVE SITES MUST BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH DURING THE DRY SEASON, BI-MONTHLY DURING THE WET SEASON, OR WITHIN 24 HOURS FOLLOWING A STORM EVENT.
- AT NO TIME MAY MORE THAN 6-INCHES OF SEDIMENT BE ALLOWED TO ACCUMULATE WITHIN A CATCH BASIN. ALL CATCH BASINS AND CONVEYANCE LINES MUST BE CLEANED PRIOR TO PAVING AND FINAL APPROVAL. THE CLEANING OPERATION MAY NOT FLUSH SEDIMENT-LADEN WATER INTO THE DOWNSTREAM SYSTEM.
- DUST GENERATED DURING CONSTRUCTION ACTIVITIES MUST BE CONTROLLED BY WETTING DUST SOURCES SUCH AS AREAS OF EXPOSED SOILS, WASHING TRUCK WHEELS BEFORE THEY LEAVE THE SITE, AND INSTALLING AND MAINTAINING ROCK CONSTRUCTION ENTRANCES. CONTRACTOR MUST MECHANICALLY SWEEP STREETS DAILY WITH VACUUM SWEEPER UNLESS OTHERWISE APPROVED.
- ANY EXCAVATED MATERIAL REMOVED FROM THE CONSTRUCTION SITE AND DEPOSITED ON PROPERTY WITHIN THE CITY LIMITS MUST BE DONE IN COMPLIANCE WITH A VALID CLEARING & GRADING PERMIT. LOCATIONS FOR THE MOBILIZATION AREA AND STOCKPILED MATERIAL MUST BE APPROVED BY THE CLEARING AND GRADING INSPECTOR AT LEAST 24 HOURS IN ADVANCE OF ANY STOCKPILING.
- WHERE STRAW MULCH FOR TEMPORARY EROSION CONTROL IS REQUIRED, IT SHALL BE APPLIED AT A MINIMUM THICKNESS OF 2-INCHES.
- PRIOR TO SEPTEMBER 15, ALL DISTURBED AREAS SHALL BE REVIEWED TO IDENTIFY WHICH ONES CAN BE SEEDED IN PREPARATION FOR THE WINTER RAINS. DISTURBED AREAS SHALL BE SEEDED PRIOR TO OCTOBER 1.
- REMOVE ALL ESC MEASURES ONCE ALL WORK IS COMPLETED AND SITE IS PERMANENTLY STABILIZED.

TESC AND TURBIDITY MONITORING:

- DISCHARGE FROM THE PROJECT SITE SHALL NOT EXCEED THE NTU LIMIT AT ALL TIMES UP TO THE 10 YEAR/24 HOUR STORM EVENT. THIS EVENT IS DEFINED AS 3.5 INCHES OF RAINFALL OVER A 24 HOUR PERIOD, AS MEASURED AT THE CITY'S RAIN GAGE. DATA FROM THIS RAIN GAGE IS POSTED ON THE CITY'S WEBSITE. THE DISCHARGE LIMIT TO A NATURAL WATER BODY IS 5 NTU OVER BACKGROUND, OTHERWISE THE LIMIT SHALL BE 100 NTU. EXCEEDANCE OF THE NTU LIMIT IS CONSIDERED A VIOLATION OF THE PERMIT AND IS SUBJECT TO STOP WORK AND CODE VIOLATION PENALTIES.
- THE CITY OF ISSAQUAH WILL MEASURE THE TURBIDITY OF ANY DISCHARGE AT THE DESIGNATED MONITORING POINTS TO VERIFY COMPLIANCE WITH THE DISCHARGE LIMIT. THE TESC SUPERVISOR SHALL BE NOTIFIED OF DISCHARGES ABOVE 25 NTUS, SO THAT ACTION CAN BE TAKEN TO KEEP DISCHARGES BELOW THESE THRESHOLD LEVELS. FOR PROJECT SITES WHERE DESIGNATING A MONITORING POINT IS NOT FEASIBLE (E.G. FLAT SITES), THE MONITORING LOCATIONS WILL BE AT THE DISCRETION OF THE CITY OF ISSAQUAH.
- MONITORING POINTS SHALL BE READILY ACCESSIBLE TO THE CITY OF ISSAQUAH AT ALL TIMES FOR ALL PHASES OF CONSTRUCTION.
- FAILURE TO PROVIDE AND MAINTAIN APPROVED TESC FACILITIES AT CONSTRUCTION SITES IS CONSIDERED A VIOLATION OF THE PERMIT AND IS SUBJECT TO STOP WORK AND CODE VIOLATION PENALTIES.
- ANY DISCHARGE TO A STREAM, LAKE OR WETLAND SHALL NOT EXCEED WATER QUALITY STANDARDS PER WAC 173-201A. FAILURE TO MEET WAC 173-201A IS CONSIDERED A VIOLATION OF THE PERMIT AND IS SUBJECT TO STOP WORK AND CODE VIOLATION PENALTIES.

ISD HOLLY STREET CAMPUS
PERMANENT CREEK REPAIR

565 NW HOLLY STREET
ISSAQUAH, WA 98027

OWNER:

ISSAQUAH SCHOOL DISTRICT
5150 220TH AVE SE
ISSAQUAH, WA 98029

CONTACT: JANELLE WALKER
PHONE: 425.306.4022

GEOTECHNICAL ENGINEER:

NELSON GEOTECHNICAL ASSOCIATES
17311 135TH AVE. N.E. SUITE A-500
WOODINVILLE, WA 98072

CONTACT: KHAL M. SHAWISH, PE
PHONE: 425.486.1669

PROJECT: 2020-19

DATE: 2021.10.22

SCALE: SEE PLAN

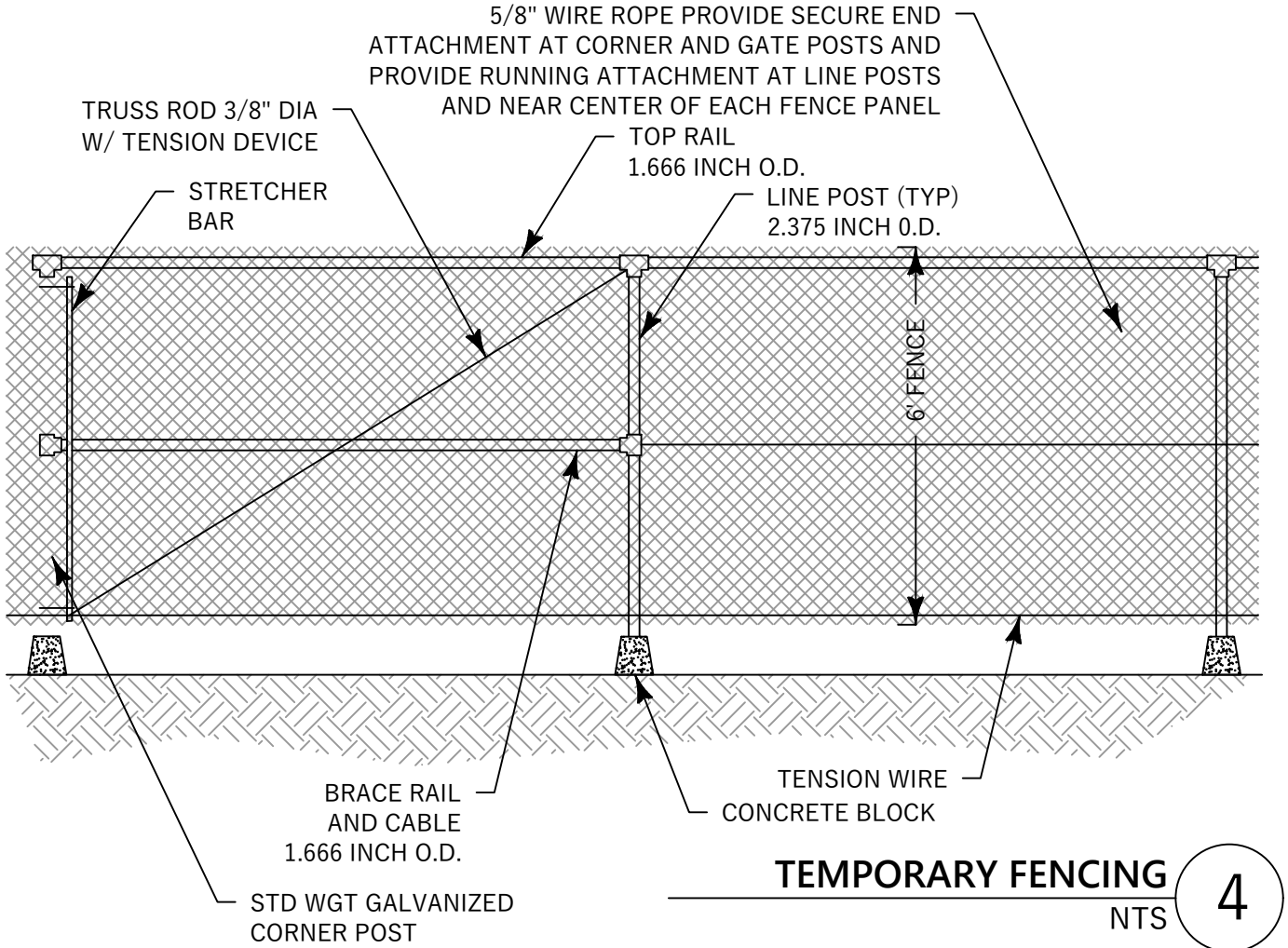
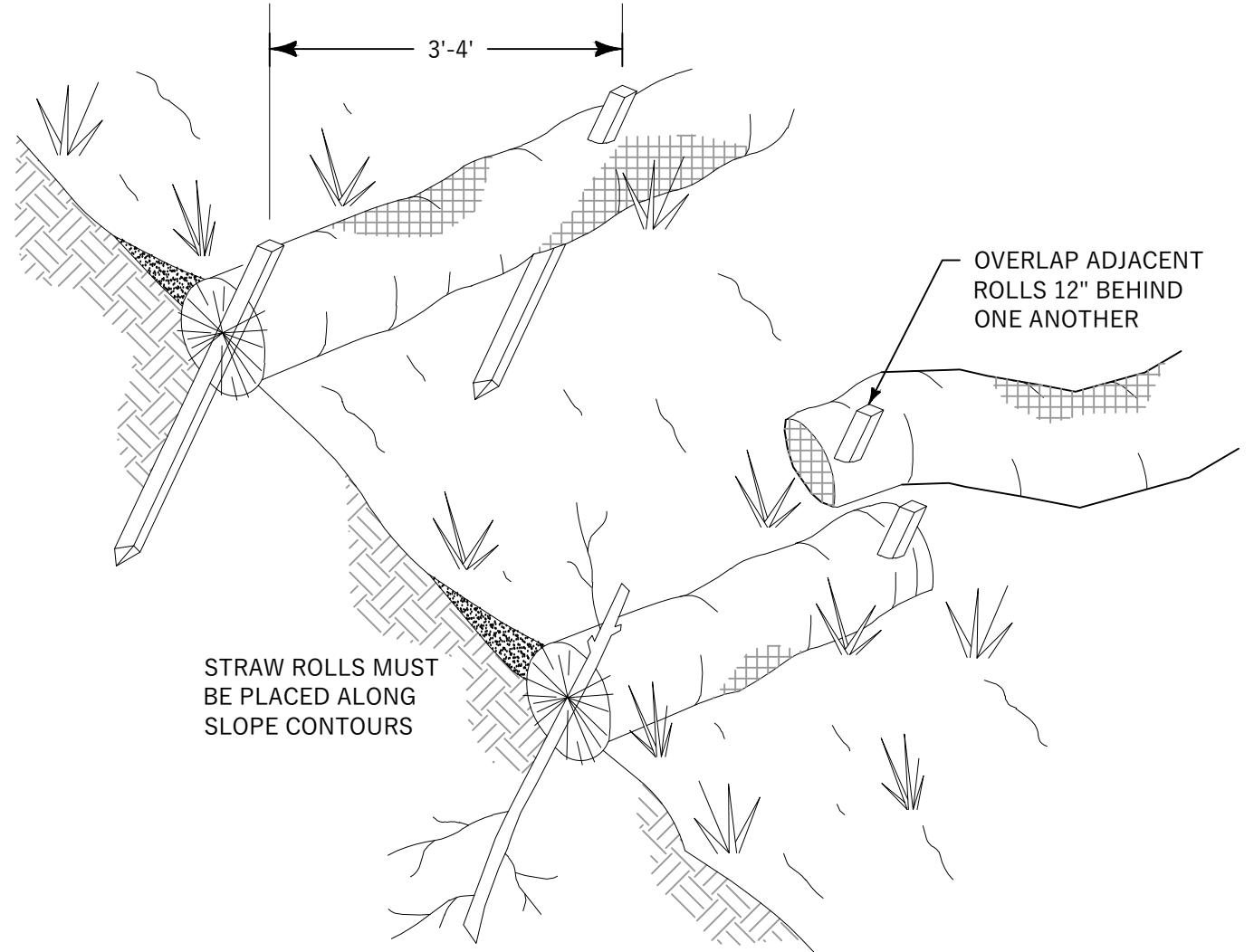
SHEET:

C-200

TEMPORARY EROSION AND
SEDIMENT CONTROL PLAN

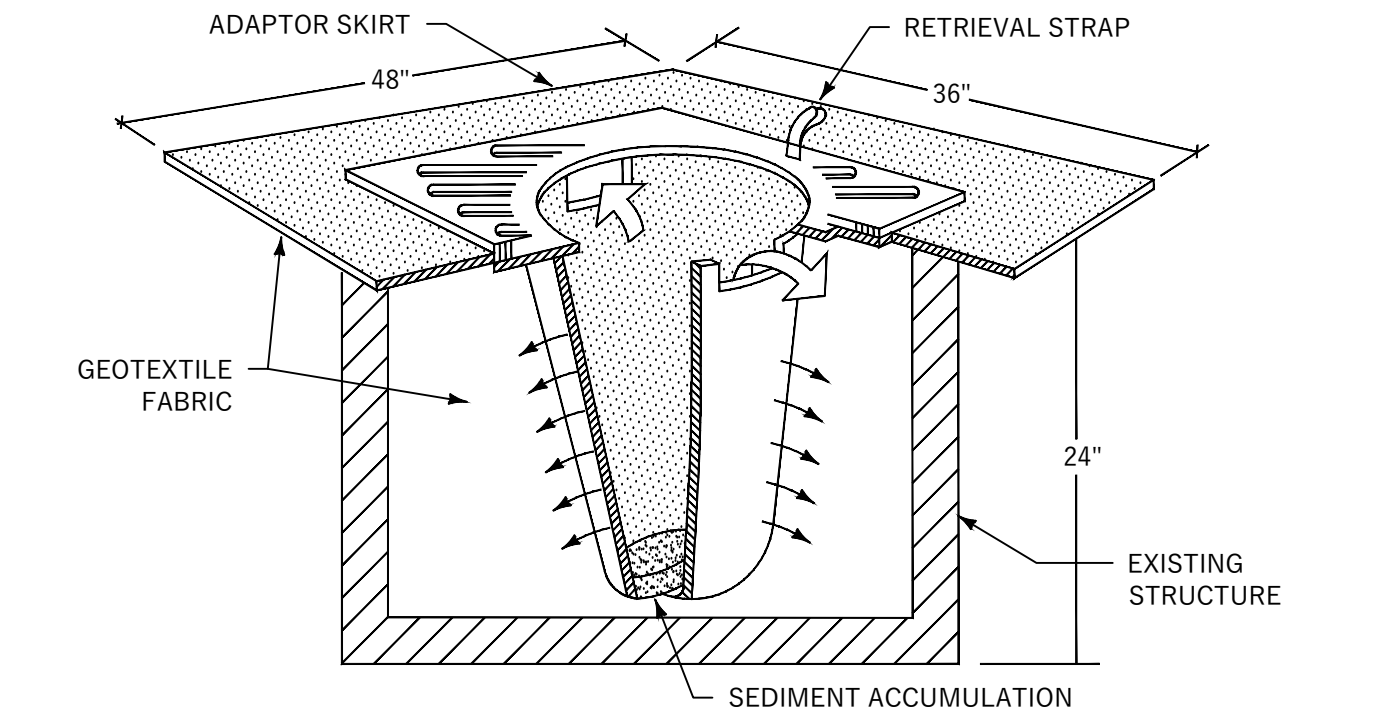
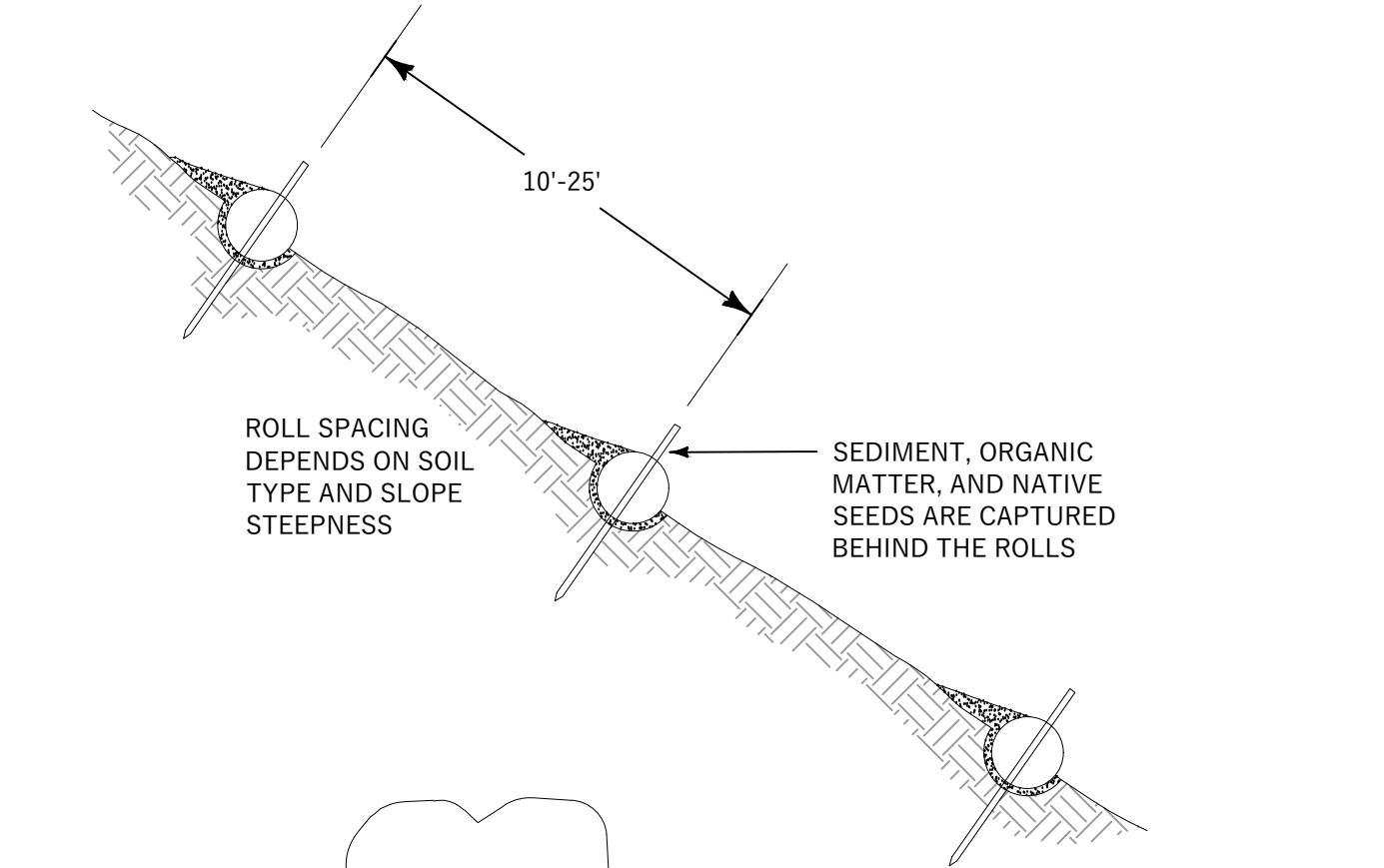
NOT USED
NTS 1

NOT USED
NTS 2



NOT USED
NTS 5

NOT USED
NTS 6

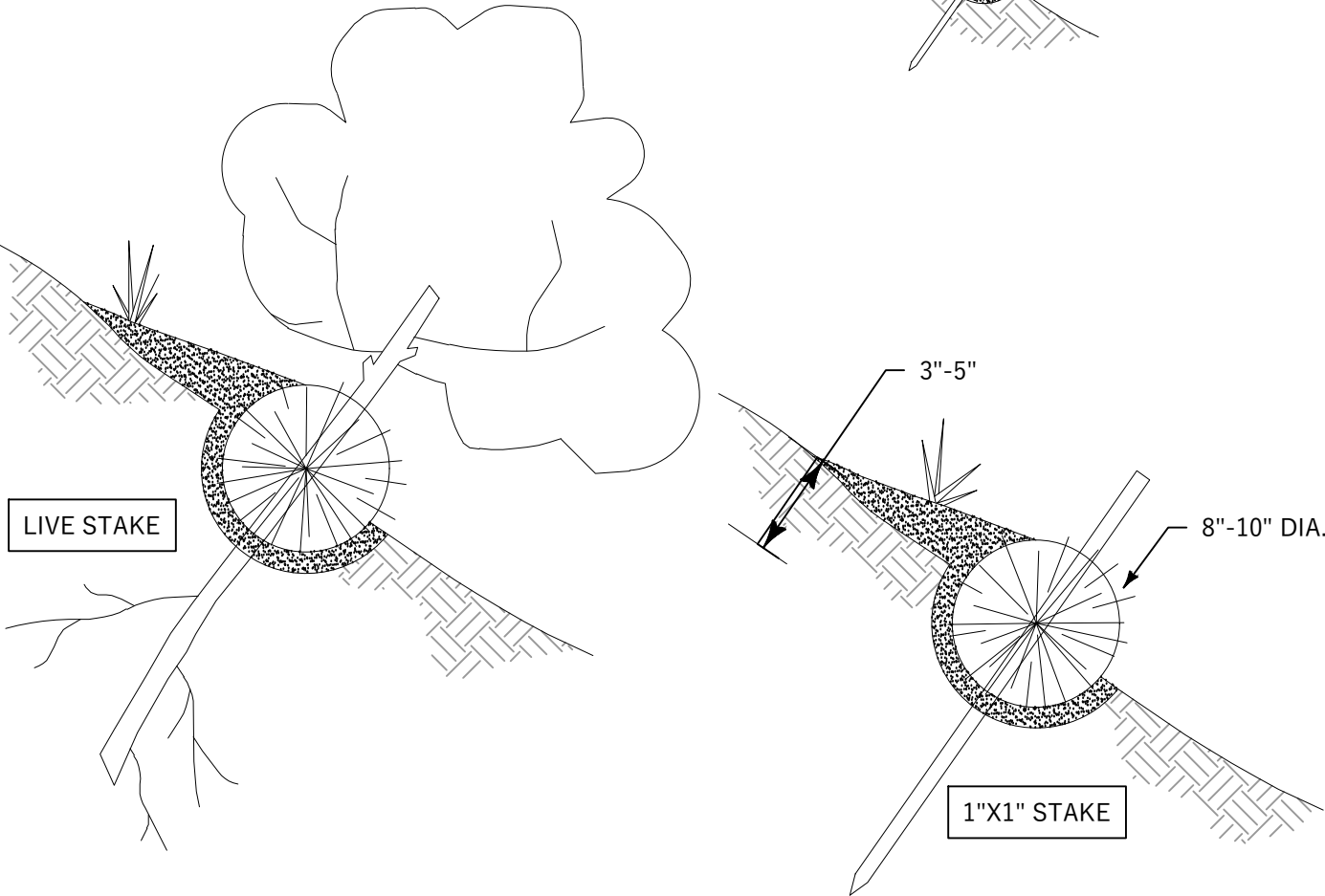


NOTES:
1. FILTERS SHALL BE INSPECTED AFTER EACH STORM EVENT AND CLEANED OR REPLACED WHEN 1/3 FULL.
2. INSTALL INLET PROECTION IN ALL NEW STORM STRUCTURES THAT WILL COLLECT STORMWATER AS THEY ARE INSTALLED.

NTS 8

NOT USED
NTS 9

NOT USED
NTS 10



NOTES:
1. FILTERS STRAW ROLL INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 3" X 5" (75-125MM) DEEP, DUG ON CONTOUR.
2. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.

NTS 11

NOT USED
NTS 12

NOT USED
NTS 13

NOT USED
NTS 14

NOT USED
NTS 15

NOT USED
NTS 16

ISD HOLLY STREET CAMPUS
PERMANENT CREEK REPAIR

565 NW HOLLY STREET
ISSAQUAH, WA 98027

NO.	REVISION / ISSUE	DATE
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OWNER:
ISSAQUAH SCHOOL DISTRICT
5150 220TH AVE SE
ISSAQUAH, WA 98029

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WOODINVILLE, WA 98072

CONTACT: KHAL M. SHAWISH, PE
PHONE: 425.486.1669

PROJECT: 2020-19	SHEET:
DATE: 2021.10.22	C-210
SCALE: SEE PLAN	

T.E.S.C DETAILS